

# FIRE MANAGEMENT PLAN

ARROWWOOD NWR COMPLEX

PINGREE, NORTH DAKOTA

*REGION 6*

*U.S. FISH AND WILDLIFE SERVICE  
DEPARTMENT OF THE INTERIOR*

June 14, 2001

**FIRE MANAGEMENT PLAN**

**for**

**ARROWWOOD NATIONAL WILDLIFE REFUGE COMPLEX**

Prepared by: \_\_\_\_\_  
District Fire Management Officer Date

Recommended by: \_\_\_\_\_  
Refuge Manager,  
Arrowwood NWR Date

Recommended by: \_\_\_\_\_  
Supervisory ROS,  
Valley City WMD Date

Recommended by: \_\_\_\_\_  
Supervisory ROS,  
Chase Lake NWR/WMD Date

Reviewed by: \_\_\_\_\_  
Regional Fire Management Specialist,  
Mountain-Prairie Region Date

Concurred by: \_\_\_\_\_  
Regional Fire Management Coordinator,  
Mountain-Prairie Region Date

Concurred by: \_\_\_\_\_  
Refuge Supervisor, ND/SD Date

Approved by: \_\_\_\_\_  
Regional Director, Date

## Mountain-Prairie Region

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## I. INTRODUCTION

Prior to the 20th century the role of fire in the northern Great Plains had been one of continued restoration of the prairie ecosystem (Wright and Bailey 1980; Pyne 1982). Fire restored vigor to plant growth, increased seed production, released nutrients, and reduced accumulated litter. This included the area now designated as the Arrowwood National Wildlife Refuge Complex (Complex).

Since the early 20th century and the establishment of the Refuge in 1935, the majority of fires within or near the refuge boundaries have been suppressed. Due to changing land use and the establishment of road systems, residences, and agriculture, habitat adjacent to the refuge has been fragmented. These activities have significantly reduced the role of fire within the prairie ecosystem. Research has fostered increased understanding of fire's role in the mixed grass prairie within the past 20 years, and has proven fire has historically influenced every native upland vegetative ecosystem in North America (Pyne, 1982).

The recognition of the natural role of fire and the need to manage our public lands more actively have promoted a push towards increased use of prescribed fire as a management tool throughout Federal land management agencies. The Arrowwood Complex is in the process of expanding its fire management program for identical reasons.

A primary objective of the US Fish & Wildlife Service (FWS) is to maintain ecosystems and their dynamic processes, of which fire is an important component. This plan provides direction for the fire management program in the Arrowwood Complex, and will help achieve resource management goals and objectives for the Complex as directed by the Station Purposes, Mission, Goals, and Objectives statement (Appendix A).

This plan addresses the use of prescribed fire as a management tool. The original Complex fire management plan was submitted in April of 1983. In February of 1996, an updated plan was completed and approved, along with an environmental assessment (EA) addressing the use of prescribed fire.

In April of 1994, an **Environmental Assessment (EA)** and **Finding Of No Significant Impact (FONSI)** were completed for upland

management within the Complex (Appendix B). These documents identify prescribed fire as one of the management tools used to "rejuvenate dense nesting cover (DNC) and manipulate plant communities within native and tame grasslands, and to reduce wildfire danger by removing buildup of heavy fuels adjacent to values at risk from wildfires."

A separate EA for prescribed fire will not be completed due to new regulations published in the Federal Register (62 FR 2375) on January 16, 1997. The new regulation categorically excludes prescribed fire (when used for habitat improvement purposes and conducted in accordance with local and State ordinances and laws. Wildfire suppression actions and prescribed fire are both now categorically excluded, as outlined in 516 DM 2 Appendix 1.

**Authority and guidance for implementation of this plan are found in:**

1. Protection Act of September 20, 1922 (42 Stat.857;16 U.S.C. 594).
2. Economy Act of June 30, 1932.
3. Federal Property and Administrative Services Act of 1949 (40 U.S.C. 471 et seq.).
4. Reciprocal Fire Protection Act of May 27, 1955 (69 Stat. 66, 67; 42 U.S.C. 1856, 1856a and b).
5. National Wildlife Refuge System Administrative Act of 1966 as amended (80 Stat. 927; 16 U.S.C. 668d-668e).
6. Disaster Relief Act of May 22, 1974 (88 Stat. 143; 42 U.S.C.5121).
7. Federal Fire Prevention and Control Act of October 29, 1974 (88 Stat. 1535; 15 U.S.C. 2201).
8. Federal Grants and Cooperative Act of 1977 (Pub. L. 95-244, as amended by Pub. L. 97-258, September 13, 1982. 96 Stat. 1003 31 U.S.C. 6301-6308).
9. Wildfire Suppression Assistance Act of 1989, (Pub. L. 100-428,as amended by Pub. L. 101-11, April, 1989).

10. Departmental Manual, Parts 620 DM-1 and 620 DM-2, Wildfire Suppression and Management.
11. United States Fish and Wildlife Service Fire Management Handbook (December 15, 1993).
12. United States Fish and Wildlife Service Refuge Manual, Chapter 6 RM 7, Fire Management (September 6, 1991).
13. National Wildlife Refuge System Improvement Act of 1997.

## **II. COMPLIANCE WITH FWS POLICY**

### **A. Purpose**

The Arrowwood Complex consists of three administrative units which includes the Arrowwood National Wildlife Refuge and Wetland Management District, the Valley City Wetland Management District, and the Chase Lake National Wildlife Refuge and Wetland Management District.

The Arrowwood National Wildlife Refuge was established under the authority of the Migratory Bird Conservation Act and Executive Order 7168 dated September 4, 1935. The refuge was designated to act "...as a refuge and breeding ground for migratory birds and other wildlife" ( 45 Stat. 1222; 16 USC 715-715d, 715e, 715f-715k, 715l-715r). The Migratory Bird Conservation Act further defined the refuge purposes by declaring the refuge "... for use as an inviolate sanctuary, or for other management purposes, for migratory birds."

The Arrowwood Wetland Management District(WMD), the Chase Lake Wetland Management District and the Valley City Wetland Management District were established as part of the Small Wetlands Acquisition Program (SWAP) under the authority of the Migratory Bird Conservation Act (16 U.S.C. 715d) "as... Waterfowl Production Areas" subject to" ... all of the provisions of such Act except the inviolate sanctuary provisions..." (16 U.S.C. 718 © (Migratory Bird Hunting and Conservation Stamp). These lands were established with the primary purpose of waterfowl production and maintenance, and to provide lands open to hunting.

The Chase Lake Prairie Project was established administratively as a Flagship Project of the North American Waterfowl Management Plan to create public/private partnerships focused on improving both public and private lands for the production and maintenance of waterfowl, migratory birds and other wildlife.

Chase Lake NWR was established by executive order in 1908 as a reserve and breeding ground for native birds, particularly white pelicans. The refuge was designated a wilderness area in 1975. The refuge is managed by personnel from the Chase Lake Prairie Project.

Easement refuges (non-fee title) were established by executive order with the intent of providing rest areas for waterfowl and

other migratory birds. Areas in the Complex are: Johnson Lake NWR, Halfway Lake NWR, Sibley Lake NWR, Tomahawk Lake NWR, Stoney Slough NWR, and Hobart Lake NWR. The FWS has no fire suppression authority on these refuges.

## **B. Goals and Objectives**

Fire is an important historic factor that shaped Complex lands for the past 10,000 to 12,000 years. The use of fire as a management tool must continue to be utilized on Complex lands to fulfill the purpose and mission of the Complex and to achieve established goals and objectives. This plan comprehensively addresses the fire management program on the Complex and how it will be used to achieve these goals and objectives.

The Mission of the Complex is to "protect and manage wildlife habitat in sufficient quantity and quality to maintain historic numbers and distribution of migratory birds and other wildlife." Goals identified for the complex as outlined in the Refuge Management Information System include:

### **GOAL 1**

Migratory Birds/Other Wildlife: Preserve, restore and enhance habitats to meet the life requirements for migratory birds and other wildlife by providing habitats representative of prairie wetlands, riparian lands, and uplands of the Northern Great Plains.

### **GOAL 2**

Threatened/Endangered Species: Conserve, restore, and enhance habitats for listed and candidate endangered species.

### **GOAL 3**

Environmental Quality: Preserve and enhance environmental quality, wild character, and natural beauty of habitats representative of the Northern Great Plains.

### **GOAL 4**

Fisheries and Aquatic Resources: Conserve and enhance the habitats of fish and other aquatic plant and animal life.

### **GOAL 5**

Technical Services/Partnerships: Provide cooperative assistance and technical expertise to and develop partnerships with other offices, agencies, organizations, and private landowners to develop and implement wildlife conservation practices.

**GOAL 6**

Environmental Education/Public Use: Provide a wide range of opportunities for compatible wildlife/wildlands-oriented interpretation, education, and recreation.

To promote these goals, the Complex has developed several objectives which relate to habitat management including:

**OBJECTIVE 1**

Maintain approximately 25,000 acres of native prairie in good to excellent ecological condition to provide the seasonal life requirements of migratory birds.

**OBJECTIVE 2**

Provide and maintain approximately 12,000 acres of dense nesting cover (DNC) to provide highly attractive nesting habitat for waterfowl and other migratory birds.

**OBJECTIVE 3**

Protect the integrity of native grassland by preventing the plowing of virgin prairie or conversion of prairie to other habitat types.

**OBJECTIVE 4**

Initiate actions which will reverse the spread of exotic perennial species into native vegetative types.

**OBJECTIVE 5**

Provide and maintain approximately 2,000 acres of seeded native grasses to provide attractive nesting habitat for migratory birds.

**OBJECTIVE 6**

Maintain approximately 500 acres of forest in good condition to provide the seasonal life requirements of migratory birds.

The use of fire as a management tool will significantly assist managers in attaining refuge goals and objectives. Periodic use of fire helps to cycle nutrients in grassland ecosystems by removing dead and decadent vegetation and proliferating native grass species. Fire can be used to stimulate native species while inhibiting or removing invading exotic species. Fire use, when timed correctly, can also increase production of seeded native grass stands and is vital to maintaining areas planted to dense nesting cover, subsequently improving available nesting habitat for waterfowl and other migratory birds. The wise and prudent use of fire can also help to maintain forest cover types by reducing hazard fuel loadings and prompting woody regeneration in decadent hardwood forest areas.

Proper upland management integrating fire management programs will help attain the habitat objectives intended to fulfill the major purposes for which units of the Complex were established. These habitats provide nesting cover for thousands of shorebirds, waterfowl, songbirds and raptors each year, and provide feeding habitat for many bird species at various times during their life cycles. Good vegetative cover promotes the health and longevity of wetland bird habitat by filtering runoff and controlling erosion into wetland basins, and preserves and maintain native plant and animal diversity including numerous unique and representative ecosystems.

USFWS policy requires that an approved Fire Management Plan must be in place for all of service lands with burnable vegetation. Service Fire Management Plans must be consistent with firefighter and public safety, protection values, and land, natural, and cultural resource management plans, and must address public health issues. Fire Management Plans must also address all potential wildland fire occurrences and may include the full range of appropriate management responses. The responsible agency administrator must coordinate, review, and approve Fire Management Plans to ensure consistency with approved land management plans.

Service policy allows for a wildland fire management program that offers a full range of activities and functions necessary for planning, preparedness, emergency suppression operations, emergency rehabilitation, and prescribed fire operations, including non-activity fuels management to reduce risks to public safety and to restore and sustain ecosystem health.

At present the Complex does not have an approved Master or comprehensive Conservation Plan. Various operational plans for the Complex include objectives which pertain to fire management.

The Complex Safety Plan objectives are to:

- provide safe working conditions for employees
- provide a safe environment for the visiting public
- protect and ensure safety of government equipment
- define safety related responsibilities of station personnel
- promote a safety attitude

The Fire Management Plan will provide direction to accomplish safety objectives during wildfire suppression actions and prescribed fire activities.

Objectives for the Chase Lake Wilderness Management Plan (1988) include; "encouraging all species of wildlife including resident game birds and big game, encouraging the maintenance and production of all migratory birds, particularly white pelicans."

Management actions in the Wilderness Plan include the use of prescribed fire to "maintain native plant composition, vigor, and promote species diversity." The Fire Management Plan is a detailed program of action to implement the above fire management policies and objectives.

### III. DESCRIPTION OF AREA AND FIRE EFFECTS

#### A. General Description

The Arrowwood National Wildlife Refuge Complex is located in Barnes, Cass, Eddy, Foster, Griggs, Steele, Stutsman, Traill, and Wells Counties, a 11,340 square mile area of east-central North Dakota. Fee title land in the complex consists of the 15,960 acre Arrowwood National Wildlife Refuge and 4,385 acre Chase Lake National Wildlife Refuge. The Complex contains 232 Waterfowl Production Areas totaling 64,211 acres and 5 Wildlife Development Areas for 3,797 acres. (see **Figure 1**). An additional 113,995 acres of wetland easements are administered out of the complex as well as 39 Farmers Home Administration (FMHA) tracts totaling 23,353 acres. The Service has no upland management authority on the wetland easements.

The Complex lies within the Prairie Pothole Region, a heavily glaciated zone having a variety of glacial land forms, among the most important of which are the various shallow wetlands and prairie lakes.

The Complex includes prairie communities with various types of native grasslands, riparian areas, and scattered woodland thickets. Woodland or forest communities are located along the Sheyenne River in the eastern part of the Complex and along the James River, which bisects the Arrowwood NWR. Other dominant features within the Complex include wetlands ranging in degree of water permanence, water depth, salinity, and land use. Agriculture is the predominant land use throughout the Complex and includes croplands, haylands, grasslands, shelter belts, tree plantings, and large areas of Conservation Reserve Program lands (CRP).



Figure 1 - Broad Scale Map of Arrowwood NWR Complex

Table 1 lists the land type inventory for the Complex, all acreage totals are estimates.

TABLE 1: LAND TYPE INVENTORY OF ARROWWOOD NWR COMPLEX				
Land Type:	AWR- NWR/WMD Acres:	CL- NWR/WMD Acres:	VC-WMD Acres:	Totals:
Seasonal Wetlands	145	1,424	1,350	2,919
Temporary Wetlands	35	483	314	832
Semipermanent Wetlands	3,280	8,610	5,339	17,229
Permanent Wetlands and Lakes	4,285	3,689	955	8,929
Croplands	1,039	800	367	2,206
Native Grasslands	9,245	28,959	2,424	40,628
Seeded Grasslands	3,906	2,750	6,115	12,771
Woodlands	176	359	97	632

<b>TOTALS:</b>	22,111	47,074	16,961	86,146
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## B. Physiography and Geology

Pleistocene glaciation shaped the landscape, dividing North Dakota from southeast to northwest into three major geological areas. These areas are 1) the Red River Valley, 2) the Drift Prairie and 3) the Missouri Coteau. The majority of the Complex lies in the Drift Prairie. Elevations vary throughout the Complex from 1400 to over 1900 feet. The soils derived from parent materials which include glaciolacustrine sediments, early Wisconsin glacial drift, and late Wisconsin glacial drift (loess).

The eastern portion of the Complex is located in the Red River Valley physiographic region. This area, characterized by flat, intensely farmed land was once the bed of Glacial Lake Agassiz. The soils are moderately well drained. The risk from wildfires or prescribed fires escaping refuge lands is low due to barriers created by intensive farming on private land. Access for fire suppression equipment is generally not a problem due to flat topography and numerous section line roads and trails.

The Glaciated Drift Plain covers the majority of the land within the Complex. This glaciated area, also known as the prairie pothole drift prairie, is characterized by gently rolling topography with numerous wetlands ranging from one-tenth of an acre to several hundred acres. Soils are silty loams and clay that are moderately well drained with areas of poorly drained soils. The meandering and wooded Sheyenne and James River valleys are located in this area of the Complex. The river valleys have numerous draws with narrow, steep slopes. Most of the area is cropland; wheat, barley, and sunflowers. The risk of wildfires or prescribed fires escaping refuge lands is low to moderate. Intensive farming and grazing on adjacent lands create barriers to fire spread during portions of the year. Access is fair to good for light and medium engines. Wetlands can pose problems due to the combination of getting stuck amidst heavy fuel concentrations. Access roads and trails are generally available.

The western area of the Complex lies within the Missouri Coteau. The Coteau has irregular terrain with an interspersion of wetlands, native prairie, hayfields, and a variety of grain crops. The Coteau is of major importance to North American waterfowl. The glacial stagnation caused the rugged topography of the area, with pothole depressions between the hills, knobs, and ridges. Soils are loamy, formed in glacial till. The risk of wildfires or prescribed fires escaping from refuge lands is moderate to high. Farming, grazing and wetlands create barriers

to fire spread in some areas. Access for light and medium engines is fair considering slope, wetlands, rocks, and limited access roads or trails. The rugged nature of the topography requires specific "local" knowledge of access routes for fire suppression actions throughout refuge and adjacent lands.

Soil erosion resulting from wildland fire suppression or prescribed fire actions is generally not a problem anywhere in the Complex. A standard fire control tactic among local cooperators is the use of disc lines. Disc lines on Complex land for suppression purposes is not recommended due to noxious weed invasion and soil erosion on slopes.

Land unit boundaries with the Complex were established along jurisdictional lines rather than geographic features. Many of the boundary lines for refuge units are conducive to fire spread onto private land due to topography.

### **C. Historical Landscape**

Most of the Complex was once native mixed grass prairie. Prairie grassland evolved in response to several natural agents, acting collectively. Climate (Clements 1916; Wedel 1956; Hastings and Turner 1966; Costello 1969), topography and wind (Wells 1965, 1970), large ungulate herds (Roe 1970), drought (Albertson and Weaver 1945) and fire (Sauer 1950; Stewart 1951, 1953; Wright and Bailey 1980; Pyne 1982) are often cited as the primary natural agents favoring grasslands over woodlands. Fires were either caused by lightning or started by Native Americans and were quite common, limited only by rainfall and natural firebreaks such as rivers and lakes (Higgins 1986).

Grasslands were broken and converted to cropland beginning in the 1890's. With settlement and fragmentation of the prairie, wildfires were eventually controlled, further modifying the historic influences on the native grasslands. Fire on prairie habitats has been essentially eliminated on private lands and much reduced on public lands.

The herbivore with the greatest impact on prairie grasslands was the bison. Herds of bison, estimated at over six million, once roamed across the prairies impacting grasslands. The grassland evolved with this impact and requires similar influences to maintain diversity and vigor. When the railroad arrived in the 1870's, it spelled the end for the bison. Commercial hunters eliminated all the large herds between 1870 and 1873. Disease carried by domestic cattle reduced bison numbers even more after 1880. Only about 500 bison remained when North Dakota became a State in 1889. Domestic cattle continue to impact grasslands with grazing. This impact differs from that caused by free ranging bison, because cattle grazing usually occurs on the same area through an entire season. This practice also allowed woody species such as western snowberry or buckbrush to invade. Some grass and forb species increased with annual grazing and became more common components of the prairie.

#### **D. Contemporary Landscape Description**

Settlement of the area began in the late 1800's and with it began the destruction of the prairie grasslands and wetlands. Over 70 percent of the privately owned land adjacent to the Complex boundary are classified as cultivated cropland. Approximately 25 percent of the privately owned land is classified as native prairie. The remaining 5 percent is in public ownership. Wetland drainage has been extensive, but wetlands are still a prominent feature of the landscape.

#### **E. Fish and Wildlife Service Land Interests**

The Complex is located entirely within the Prairie Pothole Region of the Upper Midwest. It is part of the Prairie Pothole Joint Venture area, a regional designation of the North American Waterfowl Management Plan. The Fish and Wildlife Service has management or administrative responsibilities on five different land categories. Acreages of each are listed in **Table 2**.

**Table 2: U.S. Fish and Wildlife Service Land Interests in the Arrowwood National Wildlife Refuge Complex, North Dakota**

<b>Interest Type</b>	<b>Acres</b>
National Wildlife Refuges (fee title)	20,885
National Wildlife Refuges (easement)	5,438
Waterfowl Production Areas (232 total)	64,211
FmHA Conservation Easements	23,353
Wetland Easements	113,995
Wildlife Development Area (5 total)	3,797

The land categories are described as follows:

##### **1. National Wildlife Refuges**

There are eight National Wildlife Refuges within the Arrowwood National Wildlife Refuge Complex. Of these, six are easement refuges, and only two, Arrowwood NWR and Chase Lake NWR, are owned in fee title by the Service. Stoney Slough NWR is both easement and fee title. The Service has acquired the right to control hunting and maintain water levels on the six easement refuges. All other management rights, including upland management, are retained by the landowner.

## **2. Waterfowl Production Areas**

Waterfowl Production Areas (WPAs) are purchased by the Service under provisions of the Migratory Bird Conservation Act, and are Service fee title lands. The sale of Migratory Bird Hunting and Conservation Stamps, commonly known as the "Duck Stamp", provides the funding for purchasing WPAs. The Complex staff have fire management programmatic responsibilities on these lands.

## **3. Wetland Easements**

The wetland easement program was authorized by Congress in 1958 and is financed by the sale of Duck Stamps. The Service pays landowners a one-time, lump sum payment to protect wetlands from draining, leveling, filling or burning without a permit.

The easement is perpetual and covers only the wetlands on the land. Normal farming practices such as cropping, haying or grazing when the wetlands are dry from natural conditions are not restricted by the easement. The Service has no other management authority on these lands. Burning may be permitted on wetland easements once every three years, and requires a permit issued by the Complex.

## **4. Farmers Home Administration Conservation Easements**

The Farmers Home Administration (FmHA), an agency of the U.S. Department of Agriculture, is required by Executive Order 11990 to preserve and protect all wetlands in FmHA ownership. The 1985 and 1990 Food Security Acts (Farm Bill) subsequently gave instructions pertaining to how and by whom this should be done. The Service has recommended conservation easements on FmHA properties, and, when these properties are sold, assumes enforcement and management responsibilities of the easement.

The restrictions of each easement may vary. At a minimum, wetlands are protected from draining, filling or burning. Some easements also protect upland habitats including native grassland, tame grassland and trees.

Figure 2 - Arrowwood NWR

Figure 3 - Arrowwood WMD



Figure 3a - Eddy County

**Figure 3b - Foster County**

FIGURE 3c EDDY COUNTY WATERFOWL PRODUCTION AREAS		
WPA NAME	ACRES	MAP REFERENCE NUMBER
Anderson WPA	77	1
BLM WPA	8	2
Columbia WPA	110	3
Goose Lake WPA	134	4
Haley WPA	95	5
Hanson WPA	39	6
Haven WPA	657	7
Hegland WPA	192	8
Lake Coe WPA	22	9
Langley WPA	121	10
Larson WPA	135	11
Munster WPA	48	12
Myrhe WPA	45	13
Nash WPA	52	14
Sheyenne WPA	514	15
Swan Lake WPA	1047	16
Wallace WPA	806	17
Wood WPA	239	18
Ziebert WPA	316	19

**FIGURE 3d**  
**FOSTER COUNTY WATERFOWL PRODUCTION AREAS**

WPA NAME	ACRES	MAP REFERENCE NUMBER
Barlow WPA	282	1
Bauer's Lake WPA	161	2
Blue Cloud Lake WPA	125	3
Florhaug WPA	70	4
Larson WPA	123	5
Midgely WPA	182	6
Okert WPA	231	7
Topp WPA	160	8
Zink WPA	162	9

Figure 4 - Chase Lake WMD

**Figure 4a - North Stutsman County**

**Figure 4b - South Stutsman County**

Figure 4c - North Wells County



Figure 4d - South Wells County

FIGURE 4e STUTSMAN COUNTY WATERFOWL PRODUCTION AREAS		
WPA NAME	ACRES	MAP REFERENCE NUMBER
Ackerson WPA	350	1
Ahlert WPA	43	2
Alfred WPA	42	3
Anderson WPA	139	4
Aspen Island WPA	56	5
Barnes Lake WPA	990	6
Beaver Creek WPA	75	7
Beck WPA	318	8
Blue Lake WPA	109	9
Boelke WPA	80	10
Bower WPA	69	11
Brooks WPA	248	12
Chase Lake WPA	3013	13
Chase Lake NWR	4385	14
Clemens WPA	160	15
Cleveland WPA	29	16
Cleveland Slough WPA	397	17
Cottonwood Lake WPA	410	18
Crystal Springs WPA	881	19
Dammel WPA	239	20
Dewald WPA	29	21
Dockter WPA	25	22
Dunphy Lake WPA	316	23
Durham WPA	127	24
Eckroth WPA	68	25
Eddy WPA	181	26
Eissenger WPA	80	27
Gaier WPA	657	28
Gasal WPA	136	29
Gilbert WPA	43	30

FIGURE 4e STUTSMAN COUNTY WATERFOWL PRODUCTION AREAS			
Glinz WPA	180	31	
Goter WPA	301	32	
Haglund WPA	722	33	
Hawks Nest WDA	935	34	
Hearst WPA	272	35	
Henne WPA	155	36	
Hertal WPA	256	37	
Hieb WPA	36	38	
Hoffman WPA	318	39	
Holzwarth WPA	160	40	
Horton WPA	56	41	
Jamestown College WPA	377	42	
Kautzman WPA	36	43	
Klostrich WPA	136	44	
Koenig WPA	169	45	
Kutz WPA	315	46	
Leoboldt WPA	49	47	
Liebelt WPA	179	48	
Lippert WPA	19	49	
Major WPA	263	50	
Mallard Lake WPA	221	51	
Mathews WPA	40	52	
Medicine Lake WPA	1	53	
Moon Lake WPA	55	54	
Moran WPA	180	55	
Mount Moriah WPA	640	56	
Mud Lake WPA	724	57	
North Barnes Lake WPA	481	58	
Northwestern Lake WPA	473	59	
Odeggaard WPA	160	60	
Paris WPA	80	61	
Paulson WPA	252	62	
Pearl Lake WPA	57	63	
Peda WPA	61	64	
Roosevelt WPA	320	65	

FIGURE 4e STUTSMAN COUNTY WATERFOWL PRODUCTION AREAS		
Rott WPA	246	66
Rudolphs Lake WPA	21	67
Rush Island Lake WPA	196	68
Schauer WPA	80	69
Schroeder WPA	55	70
Schuler WPA	74	71
Seckerson WPA	80	72
Seekin WPA	367	73
Siebert WPA	259	74
Sinclair WPA	19	75
Slimon WPA	217	76
Smith-Bingham WPA	239	77
Starr WPA	80	78
Stickle WPA	20	79
Stirton WPA	280	80
Strand WPA	312	81
Strong WPA	475	82
Sunday Lake WPA	289	83
Sydney WPA	80	84
Thiesen Marsh WPA	1426	85
Tischner WPA	160	86
Tompkins WPA	160	87
Vashti WPA	160	88
Walsh WPA	288	89
Wiese WPA	55	90
Winberg WPA	458	91
Woodworth Station WPA	2652	92
Zimmerman WPA	160	93
Zimmerman WPA	627	94

FIGURE 4f WELLS COUNTY WATERFOWL PRODUCTION AREAS		
WPA NAME	ACRES	MAP REFERENCE NUMBER
Ambers WPA	158	1
Berg WPA	72	2
Bibow WPA	640	3
Bjertness WPA	314	4
Bremen WPA	48	5
Bremen Slough WPA	587	6
Bullmouse WPA	70	7
Chaseley WPA	43	8
Cromwell WPA	158	9
Crystal Lake WPA	643	10
Ehni WPA	151	11
Faul WPA	320	12
Foley WPA	320	13
Frederick WPA	160	14
Fritchie WPA	160	15
Frost WPA	83	16
Hart WPA	160	17
Heeren WPA	154	18
Hoornaert WPA	312	19
Indian Hills WDA	1794	20
Kost WPA	320	21
Marzolf WPA	310	22
Monk WPA	20	23
Pipestone WDA	157	24
Pohlman WPA	320	25
Pony Gulch WDA	240	26
Radtke WPA	152	27
Schaubert WPA	70	28
Schindler WPA	155	29
Sidle WPA	121	30
Silver Lake WPA	320	31
Sorenson WPA	204	32
Sweetgrass WDA	670	33
Valhalla WPA	240	34
Weatherly WPA	160	35

FIGURE 4f WELLS COUNTY WATERFOWL PRODUCTION AREAS		
Weber WPA	149	36
Weisz WPA	240	37
Whipple WPA	640	38

Figure 5 - Valley City WMD

Figure 5a - North Barnes County



**Figure 5b - South Barnes County**

FIGURE 5c BARNES COUNTY WATERFOWL PRODUCTION AREAS		
WPA NAME	ACRES	MAP REFERENCE NUMBER
Bartz WPA	80	1
Berntson WPA	29	2
Blikre WPA	317	3
Bowen WPA	210	4
Breske WPA	126	5
Burdick WPA	84	6
Dahl WPA	35	7
Dassenko WPA	72	8
Ernie WPA	160	9
Fingal WPA	215	10
Goose Lake WPA	209	11
Grotberg WPA	75	12
Hagglund WPA	162	13
Henderson WPA	140	14
Hobart WPA	242	15
Jones WPA	48	16
Key WPA	112	17
Klein WPA	207	18
Knudtson WPA	208	19
Leegard WPA	160	20
Lettenmaier WPA	161	21
Lovaas WPA	56	22
Mansfield WPA	118	23
Mosher WPA	213	24
McLain WPA	214	25
Ohnstad WPA	82	26
Olson WPA	87	27
Peterson WPA	255	28
Sanborn Lake WPA	3	29
Sanborn WPA	147	30
Stoney Slough NWR	1420	31
Sortland WPA	239	32
Stroh WPA	13	33

FIGURE 5c BARNES COUNTY WATERFOWL PRODUCTION AREAS		
Storhoff WPA	291	34
Tolstad WPA	160	35
Tvedt WPA	740	36
Welken WPA	198	37
Wolvert WPA	100	38
West Hagglund	33	39

Figure 5c - Cass County

FIGURE 5e CASS COUNTY WATERFOWL PRODUCTION AREAS		
WPA NAME	ACRES	MAP REFERENCE NUMBER
Alice WPA	2013	1
Christl WPA	10	2
Collins WPA	320	3
Hartl WPA	80	4
Kemmer WPA	340	5
Kraus WPA	132	6
Mueller WPA	16	7
Streich WPA	268	8
Utke WPA	247	9

**Figure 5e - Griggs County**

FIGURE 5g GRIGGS COUNTY WATERFOWL PRODUCTION AREAS		
WPA NAME	ACRES	MAP REFERENCE NUMBER
Campbell WPA	166	1
Delfs WPA	60	2
Eberle WPA	85	3
Evers WPA	577	4
Graving WPA	118	5
Guy WPA	45	6
Helland WPA	181	7
Johnson WPA	762	8
Lake Addie WPA	110	9
Larson WPA	481	10
Rix WPA	40	11
Ronningen WPA	126	12
Tande WPA	80	13
Walum WPA	340	14
Wogsland WPA	242	15
Zimprich WPA	53	16

Figure 5g - Steele County



**FIGURE 5i**  
**STEELE COUNTY WATERFOWL PRODUCTION AREAS**

<b>WPA NAME</b>	<b>ACRES</b>	<b>MAP REFERENCE NUMBER</b>
<b>Dronen WPA</b>	<b>92</b>	<b>1</b>
<b>Erickson WPA</b>	<b>160</b>	<b>2</b>
<b>Fritz WPA</b>	<b>80</b>	<b>3</b>
<b>Fuller's Lake WPA</b>	<b>673</b>	<b>4</b>
<b>Fugelstad WPA</b>	<b>322</b>	<b>5</b>
<b>Hornbacher WPA</b>	<b>449</b>	<b>6</b>
<b>Rogers WPA</b>	<b>340</b>	<b>7</b>
<b>Salander WPA</b>	<b>348</b>	<b>8</b>
<b>Shaw WPA</b>	<b>635</b>	<b>9</b>
<b>Thorson WPA</b>	<b>32</b>	<b>10</b>

FIGURE 5i STEELE COUNTY WATERFOWL PRODUCTION AREAS		
Thykeson WPA	80	11
Wigen WPA	80	12

Figure 5i - Traill County

FIGURE 5k TRAILL COUNTY WATERFOWL PRODUCTION AREAS		
WPA NAME	ACRES	MAP REFERENCE NUMBER
Elken WPA	166	1
Erickson WPA	192	2
Groven WPA	80	3
Thompson WPA	274	4

## F. Climate

The Complex's climate is classified as semiarid to subhumid continental. It is characterized by long, cold winters, moderately warm summers and rapidly changing weather patterns. The average growing season ranges from 98 to 106 days. The average daily summer temperature is in the mid to upper 60's (°F) with the average high temperature in the upper 70's to low 80's. The average winter low temperature ranges from -1 to -5°F. The coldest temperatures vary from -40 F to -60 F with summertime highs up to 112 F. Average annual snowfall ranges from 30 to 40 inches. The average annual precipitation ranges from 16.7 to 17.5 inches with almost 80 percent occurring between April and September. The Complex is a National Fire Danger Rating System (NFDRS) climate class 1 area (semiarid).

Intense thunderstorms occur frequently in summer. In the winter, snow and high winds bring frequent blizzard conditions to the area. The frost free season generally runs from May 20 - September 15. January is the coldest month and July is the warmest. The prevailing wind flow is from the northwest with an average daily speed of 10+ mph. Winds are usually sustained strong breezes rather than occasional gales. Wind speeds are usually highest during the afternoon and lowest at night. Winds of 25-30 mph or more often last for over six hours and have been recorded for several days, sustained gusts of 35-50 mph are not uncommon.

Green up of cool and warm season grasses is dependent on temperature, precipitation and soil moisture. Drought years often produce little or no green-up for the entire year. Year to year variations in green up and curing of grasses affect fire danger throughout the growing season.

Typical cycles in the area include a transition from cured to green up in April and early May, with late May, June and much of July in a green state. The late summer-fall transition period from green to cured starts in middle to late July and continues until early September. The onset of frost in mid September generally brings about full curing of vegetation, remaining in this condition until the spring transition to green up occurs.

## G. Soils

The soils in the 9-county Complex are of two major categories; recent

alluvium and glacial deposits. Glacial deposits consist primarily of glacial till and glacial lacustrine sediments. The soils formed in glacial till are loam or clay loam with thin seams and lenses of sand and gravel, ranging in thickness from 50 to 200 feet.

There are 18 individual land capability classes and subclasses consisting of over 300 soil types. The soils have been inventoried by the Natural Resource Conservation Service, formerly the Soil Conservation Service, an agency in the U.S. Department of Agriculture. Soil surveys and maps for all nine counties are kept on file at the Complex headquarters and are used when planning upland management activities to help determine which management practices are appropriate on particular tracts or portions of tracts.

## **H. Water Resources**

The wetlands in the Complex are extremely productive and very attractive to migratory waterfowl and resident wildlife. They serve as breeding and nesting areas for many migratory birds and as wintering habitat for many species of resident wildlife. Approximately 35,000 acres of wetlands exist on Complex lands, most of which are potentially burnable at one time or another.

Glaciated "prairie potholes" are one of the most obvious water resources in the Complex. Wetland densities exceed 270 wetlands per square mile in some portions, particularly Missouri Coteau. These wetlands are extremely productive and are used as breeding and nesting habitat for many species of migratory birds.

The James River is the other major water resource. It drains an area of about 15,000 square miles in North Dakota. The James originates near Fessenden, North Dakota, entering the Missouri River near Yankton, South Dakota, a total distance of 747 miles. There are approximately 200 miles of the James River in North Dakota, with 16 miles of the River within the boundaries of Arrowwood NWR. Most of the native riparian woodlands in the Complex are found along the James River.

Portions of the Complex are within the Sheyenne and Red River watersheds. The remainder of the Complex is within the watershed for the James River. The various river systems within this watershed, along with the numerous wetlands throughout the Complex, allow for the use of these areas as natural barriers in both suppression and prescribed fire planning when sufficient water levels exist. During drought years or following impoundment or wetland drydown in the late summer and fall, these wetland and riparian areas supporting heavy mats of cattail or phragmites (fuel model 3) have the potential to cause wildfire control difficulties.

Many of the prescribed burns conducted in the Complex are adjacent to water resources; some, such as cattail reduction burns, may take place over water or ice. Post fire erosion and wind born ash deposition impacting water resources is not a concern for the type and scale of burns conducted on the Complex. Burn size is generally small (average 80-600 acres) and grass fuels do not produce heavy volumes of ash as compared to forest fuels.

Terrain and slope also effects fire management impacts on water resources. Terrain and slope on Complex lands are mostly flat to gently rolling, with little or no slope present, or areas of slope with short vertical distances. Furthermore, the mixed grass prairie is an adaptive fire community, and will significantly revegetate within one to two weeks of burning throughout the growing season (May

15 through September 15). Thus soil erosion is of little concern on most of the lands managed by the Complex. Supporting documentation regarding fire effects on water resources can be found in Effects of Fire on Water: A State of the Knowledge Review (1979).

## **I. Vegetation**

With 232 Waterfowl Production Areas covering over 64,211 acres, 5 Wildlife Development Areas covering 3,797 acres and over 20,885 acres of Refuge fee title lands, completion of comprehensive vegetative surveys has been impossible. All WPA's have undergone basic site classification surveys consisting of walk through vegetation composition surveys, classification of habitat type (native prairie, dense nesting cover (DNC), meadow, wet meadow, wetland and wetland type, seeded native grassland etc.) and have recorded histories of management including the use of prescribed fire and wildfire occurrence.

Vegetational resources on the Complex are diverse. A refuge plant listing was compiled in 1947, documenting over 300 species on refuge lands. This was prior to the establishment of the Wetland Management District, covering lands throughout nine counties and potentially increasing the overall species occurrence list. No additional vegetative surveys have been conducted since 1947 on lands contained within the Complex. Due to vegetation composition changes over time, vegetation covers needs to be re-mapped in the future to provide accurate estimates.

A partial species list can be found in Appendix D.

In general, both the range condition and vegetative condition of the Complex are in fair to poor condition based on the species composition and general vigor. The primary reason the grasslands are not in better condition is the lack of correct periodic treatments on these grasslands. A review of past management of Service lands indicates that treatment has been sporadic and many units have received from 5 to 15+ years of rest. This lack of treatment, formerly described as the "rest is best" theory of management, occurred due to many factors. Complex staffing has never been at the level necessary to conduct the management actions necessary to maintain ideal grassland conditions, and it was easier to have a permittee hay or graze the land, or just keep it in an elongated rest cycle, than to intensely manage the area with a combined management style.

### **1. Native Grasslands**

Approximately 26,000 acres in the Complex are classified as native grassland. This represents 30 percent of the total upland acreage in fee title ownership. The Complex is located in the transition zone between the western short grass and eastern tall grass prairies. The primary species typical of this mixed grass prairie are green needle grass, western wheat grass, blue grama and prairie junegrass with little bluestem, big bluestem and switchgrass found in mesic sites with more moisture.

Extensive invasion of native prairie by exotic species including Kentucky bluegrass, smooth brome, leafy spurge, Canada thistle and crested wheat grass has occurred. Silverberry and western snowberry have increased within native grasslands in many areas of the Complex.

The majority of fee title grasslands in the WMD's had been converted to cropland at some point in their history prior to Service acquisition. In most cases the area was farmed long enough to destroy the native plant species that existed, or was seeded to tame grass.

Remnant native prairie tracts can still be found in portions of the Complex to a degree that represents native biotic communities. However, these native prairie tracts are scarce and isolated, and many of these tracts have also been heavily invaded by smooth brome grass, Kentucky bluegrass, quackgrass and leafy spurge.

One of the simplest and least expensive practices to improve and restore grasslands is prescribed burning. Prescribed burning can be used to target individual species or categorical grassland components (native vs. exotic). Selective suppression or promotion of a particular species depends on the date of the fire in relation to the phenology of the particular species (Higgins, Kruse, Piehl 1986). Appropriately timed prescribed burning will be used to manage Complex grasslands. Research conducted on the Arrowwood NWR Complex in central North Dakota found a marked increase in species diversity after prescribed burning (Kirsch, Kruse 1972).

Prescribed fire will also be a major component of management efforts to restore areas of native prairie in the Missouri Coteau portion or the Complex. Many of these areas are already too far gone to reclaim from their current state of predominantly woody vegetation coverage.

Depending upon the time of year, drought conditions and other physiological plant characteristics, large wildfires could have positive and/or negative effects on both native and exotic grass species. When possible, the Complex will monitor fire effects of certain wildfires in an effort to improve prescriptive parameters.

## **2. Seeded Native Grasses**

Some areas of former cropland, approximately 4,000 acres, have been seeded to native grass species including switchgrass, big bluestem, little bluestem, sideoats grama, western wheat grass, and green needle grass. In general, areas that were seeded in the 70's and early 80's have relatively poor stands of native grass due to improper seeding methods that did not place seed at the proper depth and compaction, seed varieties that were not adapted to northern North Dakota, lack of management after seeding, and poor weather conditions following seeding. Later seedings utilized northern adapted varieties and show better success rates.

Prescribed fire is the primary management tool used on seeded native grasses in the Complex. Without a fire treatment, litter accumulation increases until there is very little ground surface receiving sufficient light for new growth. Cool season exotic species such as Kentucky bluegrass, quackgrass and smooth brome establish themselves early in the spring before the warm season natives, filling whatever free space is available. By the time the ground warms sufficiently for the warm season natives to sprout, they are effectively shaded out by the cool season

exotics. In many areas of the Complex, the native component is only visible upon close inspection under the litter layer where they are hanging on in stunted growth.

Periodic prescribed burning of seeded native grasses areas can have incredible effects on native grass vigor and composition. Timed burning after the cool season exotics are actively growing but before the warm season natives are well developed will significantly reduce the exotic grass vigor and open up the ground surface to allow the natives to expand, often exponentially. On decadent plantings, just the removal of the dense litter layer through burning will aid the native component for the following year or two. Maintenance burning in native seedings are most effective when burned on a one to three year rotation, and Kentucky bluegrass can often be nearly eliminated by three or more consecutive year burns (Kirsch and Kruse, 1972).

### **3. Dense Nesting Cover**

Approximately 9,000 acres of former croplands have been planted to a mixture of grasses and legumes which produce a "dense nesting cover" (DNC) that is particularly attractive to upland nesting waterfowl. This mixture usually includes tall wheat grass, intermediate wheat grass, alfalfa and sweet clover.

DNC is very important to upland nesting birds, especially ducks, making a major contribution toward achieving the waterfowl production objectives of the Complex (Duebbert 1969; Duebbert and Lokemoen 1976; Higgins and Barker 1982). Some of these stands provide excellent nesting and winter cover. Many have declined in productivity due to the tendency of smooth brome grass to invade and predominate the stand and then to become sod bound without proper management. Other problems associated with DNC areas is the tendency to become heavily intruded by leafy spurge, another exotic plant species. Current management techniques used to rejuvenate DNC include prescribed burning, mowing, haying, mowing or haying with scarification, grazing, interseeding and conversion to cropland to prepare seedbeds for eventual reseeding. Prescribed fire is a useful tool in DNC areas, but its use as a management tool has several limitations. Fire in DNC areas must be completed either before initiation of legume growth (alfalfa and sweet clover), or after these species have gone into dormancy in the fall. Fire during their growth state can severely impact plant vigor. Fire prior to the growth spurt in the spring can open up the area for increased intrusion by leafy spurge and other exotic plant species. The application of fire is used to reduce litter layers, rejuvenate DNC plantings, and to remove the heavy collection of surface detritus to allow for ease of interseeding or reseeding.

### **4. Tame Grass**

Approximately 15,000 acres of upland are classified as tame grass. These areas were once cropland but have been seeded to grass. Most is smooth brome, but there are also areas of crested wheat grass, quackgrass and mixtures of grasses and alfalfa. Much of this land was seeded 20-50 years ago.



Some areas were allowed to revert to whatever vegetation would grow after being abandoned as cropland while privately owned or shortly after Service acquisition. Management options on these areas are limited by species composition and soils. Some tracts are so completely dominated by decadent stands of undesirable grasses that reseeding to more desirable species may be the best management technique to use. Prescribed fire is used to promote this management tactic by removing the heavy accumulated litter mat allowing ease of working and reseeding the area.

Grassland species of the northern great plains evolved under periodic disturbance and defoliation from several factors, with the primarily influences being bison (Roe 1970) and fire (Wright and Bailey 1980; Pyne 1982). Proper management of these grassland areas requires a mixed management style incorporating the needed components of fire, grazing, and/or haying in the proper distribution and correct timing to imitate the natural cycles and ultimately produce the landscape changes needed to perpetuate this dwindling natural ecosystem.

Fire is an important grassland management tool and is vital to the health and vigor of grassland ecosystems. Fire reduces litter and increases grass stand vigor and diversity. Fire can be used to manipulate plant species composition, reduce the intrusion of exotic species, and reduce or eliminate woody vegetation. Periodic application of fire to grassland ecosystems is the best and most economical method available to managers for managing Complex grassland ecosystems. The use of prescribed fire to manage Complex grassland ecosystems is and will continue to be a primary management tool on the Arrowwood NWR Complex.

## **5. Woodlands/Forests**

The Complex contains approximately 632 acres classified as woodlands, with the majority of these acres located within the Arrowwood NWR, primarily in the riparian areas. Woodland areas on the Complex can be broken into three distinct categories.

**a) Riparian Gallery Forest:** Woodlands consisting of hardwood species of green ash, cottonwood, American elm, box elder and oak. Typically these areas are found adjacent to the James River and associated feeder streams. This forest type is fire intolerant and normally will only support fire during drought conditions and in early spring or late fall when overstory leaf coverage is absent.

**b) Brushlands:** Complex brushlands consist of mixed hardwood brush areas on the north facing slopes of ridges, buckbrush and choke cherry intrusion in grasslands, and willow establishment in wet meadow areas. Brushlands have expanded rapidly over the past 20 years. Much of this can also be attributed to lack of fire. Increased litter depth in areas absent of periodic litter removing fire serves to change the natural moisture regime of the area, thus favoring brush species over grass. Prescribe burning will be used to address this problem within the Complex.

**c) Plantings:** Various areas on the Complex have received tree plantings in the past 50 years. Typically these areas can be broken down into plantings for erosion control

(shelter belts), and ornamental plantings around old farmsteads prior to the land being purchased by the Service. Less than 100 acres of these sites exist on the Complex. Non-native tree plantings are managed as part of the adjacent upland habitats and do not receive special management. Many of these areas are valuable for wildlife, providing food, shelter and breeding areas throughout the year. These areas typically are not adapted to fire, and efforts must be made to exclude them from all wildland fire. Some planted species, specifically Russian olive and Siberian elm, are invading grasslands and require management attention. Prescribed burning is a useful tool in controlling these exotic invader species.

The remaining woodlands are found scattered around old farmsteads or shelter belts established when the land was privately owned. Invasion by undesirable tree species is occurring on some WMD grasslands, similar to what is happening on the refuge.

## **6. Wetland Vegetation**

Wetlands comprise about 35 percent of the land within the Complex. The four major wetland classes are temporary, seasonal, semi-permanent and permanent (Stewart and Kantrud 1971). Permanent wetlands contain a deep water zone which does not normally support aquatic vegetation. Wetland or aquatic vegetation refers to those plants which have evolved to grow in anaerobic soils which are saturated for most of the growing season. Wetland vegetation is divided into four major categories based on their growth form and wetland zone they inhabit. The categories are free floating, submergent, emergent and amphibious plants. Individual wetlands commonly have representatives of all four categories of wetland plants present.

Often, short term management of fuel model 3 wetland areas can be accomplished by prescribed fire. Thinning out cattail and bullrush stands and creating open water for indigenous and migratory bird species is a management option under certain weather trends. Fire alone will not manage these resources for more than the first growing season, but fire in conjunction with water level management can be very effective.

## **7. Endangered Plants**

Currently there is one federally listed plant in North Dakota, the western prairie fringed orchid. There are also 5 species listed as sensitive in the state including Hayden's yellow tress, wolf's spikerush, Dakota wild buckwheat, handsome sedge and elk sedge. Federally listed endangered species for North Dakota can be found in Appendix E.

There are 54 plant species listed as Natural Heritage State listed species that may occur on Complex lands. Of these, 12 are listed as S-1 species (critically endangered in the state),

and 17 listed as S-2 (endangered in the state). The number and distribution of these species on Complex lands is currently unknown. The North Dakota state species of concern listing can be found in Appendix G.

## **8. Noxious Plants**

Several plant species included on North Dakota's noxious weed list are found on Service land in the Complex. The most widespread is leafy spurge, but Canada thistle, absinth wormwood and perennial sow thistle are also present. These plants often compete with and have a negative effect upon native and desirable introduced vegetation. The control of noxious plants is important to benefit native plant communities and is required by State law.

Leafy spurge presents the greatest threat to Service uplands, because it is nearly impossible to eradicate, has no natural enemies native to North America, has several methods of spreading and adapts to a wide variety of sites and soil types. Several species of insects (flea beetles) that control leafy spurge have been imported from Europe and released at numerous insectaries throughout the Complex as a biological control method.

Once established, these insectaries can be vulnerable to fire if burned during the season of insect activity. Fire should be avoided in these areas between June 15 and September 1. Prescribed fire can also be used as a tool to proliferate the spread of the flea beetles by removing excessive litter layers in areas adjacent to release sites to provide quality expansion habitat for the beetles. Excessive litter layers reduce the overwintering capabilities of the flea beetles, in some cases completely destroying insectaries during long winters with heavy snowfall. Selectively prescribed burning areas adjacent to insectaries on a yearly basis is a management tool the Complex uses to assist in the establishment and expansion of flea beetle spurge control sites.

Purple loosestrife has not been documented as occurring in the Complex.

Fire can be a useful tool in the management of some of these exotic invader species, but generally must be used in conjunction with other management devices to achieve good results.

## **J. Wildlife**

### **1. Endangered, Threatened, and Species of Special Concern**

The Complex contains a number of threatened and endangered species and species of special concern. The Complex will implement its fire management program within the constraints of the Endangered Species Act of 1973, as amended, and will take appropriate action to identify and protect from adverse effects any rare, threatened, or endangered species located within the Complex. Service policy requires that State and Federal threatened and endangered species and species of special concern will be incorporated into any planning activities. Appendix E, F and G contain lists of Endangered and Threatened Species and Species of special concern occurring in the Complex.

**Table 3:  
Threatened and Endangered Species of the Arrowwood NWR Complex:**

<b>Common Name:</b>	<b>Scientific Name:</b>	<b>Classification:</b>
Black Tern	<u>Chlidonias niger</u>	Threatened
Bald Eagle	<u>Haliaeetus leucocephalus</u>	Threatened
Peregrin Falcon	<u>Falco peregrinus</u>	Endangered
Whooping Crane	<u>Grus americana</u>	Endangered
Piping Plover	<u>Charadrius melodus</u>	Threatened

The bald eagle, peregrine falcon and whooping crane have been present during spring and fall migrations. The Black Tern and Piping Plover nest within the Complex.

Fire is a natural and essential part of the Complex ecosystems. Native wildlife evolved with fire and have developed means of tolerating and/or benefitting from fires. However, the sensitive nature of some of the above species requires that their habitats be protected from large wildfires especially where adjacent habitat is lacking. Prescribed burning in areas where threatened, endangered, and candidate species exist will be conducted such that small to medium size burns (10-300 acres) can be used to increase local habitat diversity, thus aiding these species of concern.

Studies conducted at Lostwood NWR, North Dakota found that piping plover nesting success increased as a response to prescribed burning on beaches (Smith, Murphy, Michaelson, Viehl 1993). Increases were attributed to the reduction of live and residual vegetation. Prescribed burning will be used where applicable to improve piping plover habitat and increase nesting success.

Baird's sparrows are a species of special concern that are found throughout many areas of the Complex. Baird's sparrows nest in extensive idle or lightly grazed mixed grass prairie in the prairie pothole region. Studies conducted at Lostwood NWR in northwestern North Dakota showed that Baird's sparrow populations increased on areas treated with at least three prescribed burns over a 12 year period (Madden, Hansen and Murphy 1997).

The Service maintains a listing of Migratory Nongame Birds of Management Concern. Numerous species listed in this document are found on the Complex (**Appendix F**) including golden eagle, short-eared owl, forster's tern, common tern, loggerhead shrike, sharp-tailed sparrow, clay-colored sparrow, grasshopper sparrow, burrowing owl, eastern bluebird, upland sandpiper, willet, marbled godwit, orchard oriole, black-billed cuckoo, bobolink, lark bunting and others. These species use Service lands for either migration or breeding habitat, and many of them are grassland dependant species.

Many of these species need periodic fire in their nesting and breeding habitat to reduce litter buildup and woody plant intrusion to further habitat use and nesting success (Madden, Hansen and Murphy 1997).

An additional listing of North Dakota species of special concern

is maintained by the State of North Dakota Parks and Recreation Department. Numerous species of state concern are found on Complex lands (Appendix G).

It is important to reiterate that these species are typical of mixed grass prairie areas and have evolved with fire as an integral part of their life cycle. The use of prescribed fire with correct life cycle timing is vital to these species. Wildfire at the wrong time could adversely impact some of these species as well, and fire managers must take this into consideration when planning appropriate management responses to wildland fire incidents.

## **2. Invertebrate Populations**

Invertebrates are vital to the value of Service land as breeding areas for birds and other wildlife. Wetland and upland invertebrates make up part of the food base for almost all birds during portions of their life cycles. Because of the important role of invertebrates in the lives of birds, management planning must consider potential impacts on the invertebrate community.

Siltation, erosion, and combustion of deep organic soils may be detrimental to these populations. Although siltation and erosion are uncommon byproducts of wildland fire in this area, fire during drought cycles in organic soil areas could adversely affect this important ecosystem component, potentially sterilizing the soil, thus reducing the invertebrate component for several years.

Insect life and range of occurrence of insects are not well documented on the Complex. Fire causes an immediate decrease in insect populations (except ants, other underground species, and flying insects), followed by a gradual increase in numbers as the vegetation recovers. The insects eventually reach a population level higher than adjacent areas, then decline to near present levels as vegetation and soil litter stabilize (Higgins, Kruse, and Piehl 1986).

Flea beetle Insectaries established to support leafy spurge control must also be considered in fire management activities. This is discussed in detail in section I-8 of this plan.

## **3. Fish**

The majority of the Complex is found within the James River watershed. Numerous species of fish have been documented both in this watershed and in the 9-county WMD's. The majority of these species occur in the James River, other perennial streams and deeper ponds and lakes of the Complex.

The only Federally listed species in North Dakota is the pallid sturgeon (*Scaphirhynchus albus*). There are an additional seven candidate species. None of these have been documented on Complex lands.

Since siltation and erosion caused by vegetative removal from wildland fire is generally not an issue in this area, the impact on local fishery resources is negligible.

#### **4. Reptiles and Amphibians**

Several species of reptiles and amphibians have been documented, but no comprehensive survey has been done. Tiger salamanders and leopard frogs are common amphibians. The red-sided garter snake is a common reptile. Several species of reptiles and amphibians have been documented in the Complex, but comprehensive surveys of all units have not been done. Based upon state lists, it is likely that a total of four snakes, four frogs, three toads, two salamanders and two turtles may be found in the Complex.

Again, it is important to reiterate that these species are typical of mixed grass prairie areas and have evolved with fire as an integral part of their life cycle. Due to the life cycles, habitat use and abundance of the limited number of reptile and amphibian species in the area, it is unlikely that wildland fire has a significant negative impact on any of these resources.

#### **5. Birds**

A total of 266 bird species have been recorded in the Complex. Of this total, 124 have been documented as nesting species including North America's largest colony of White Pelicans. The "Arrowwood NWR Bird List", included in Appendix H, provides a summary of the bird species found in the Complex.

The full range of passerine and other birds common to the Northern Great Plains prairie/wetland ecosystem, including many neotropical species, are found in the Complex during some part of their life cycle. Non-migratory birds include sharp-tailed grouse, gray partridge, ruffed grouse and ring-necked pheasant. Sharp-tailed grouse are good indicators of the health of upland grassland habitats since they are a native species that has evolved in grassland ecosystems. Their population has fluctuated in recent years, mainly due to adverse weather conditions during the nesting season which reduced reproduction. However, historic leks on portions of the refuge badly invaded by silverberry and western snowberry no longer exist. This indicates the value of these areas as grassland habitats has decreased, further exposing the role of fire in this ecosystem to maintain native flora and fauna components.

Bird species evolving with fire may show fire adapted behavior and responses, whereas other species exposed infrequently to fire in their evolutionary history may be severely inhibited by fire (Best 1979). Research conducted at Arrowwood NWR from 1969-1971 concluded a greater variety of nesting bird species were found on burned areas, duck and sharptailed grouse production was higher on burned areas, hatching success of ducks was higher on burned areas, and there was a marked increase in plant variety after burning (Kirsch and Kruse 1972). Other studies concluded that duck nesting success was significantly greater in fall burned plots than in spring burned plots for all duck species. Results suggested that vegetation structure and duck nesting response to spring and fall burns became similar after the third post fire growing season (Higgins 1986).

Studies conducted between 1979 and 1995 by Murphy and Smith at Lostwood NWR on the effects of periodic prescribed fire on grassland passerine species abundance and composition on mixed grass prairie areas in northwestern North Dakota showed a

dramatic increase in passerine numbers in the year immediately following a burn. This increase in some instances was up to ten-fold of preburn numbers. Typical trends depicted by the study show dramatic increases for the first three years after the burn, with numbers reverting back to preburn levels five to six years after the burn treatment.

## **6. Mammals**

All mammals common to this portion of the Northern Great Plains are found in the Complex. Some of the most common include white-tailed deer, jackrabbit, coyote, red fox, raccoon, muskrat, beaver, striped skunk, and several species of small mammals including Richardson's ground squirrel, deer mice, red squirrels, voles, and shrews. Moose, elk and mule deer are occasionally observed on Complex lands. Service uplands are important for forage and cover for these species during their life cycle.

Comprehensive inventories of mammal species have not been completed for all units in the Complex. Generally, the direct impacts of fire on wildlife include disturbance or infrequent mortality of individuals or groups of individuals, particularly slow moving and or sedentary species. The Complex's larger mammals (deer, coyote, fox) will generally move away from fire. However the availability of suitable adjacent habitat is important for local populations. This factor is particularly important in the WMD's where Service units are small and surrounded by intensively farmed cropland. Extensive fall prescribed burning is generally not conducted in the WMD's for this reason.

Fire in the mixed grass prairie has been shown to generally favor deer and other mammals (Coppock and Detling, Herman and Wright, and others). Information concerning the effects of fire on wildlife can be reviewed in The Effects of Fire in the Northern Great Plains, prepared by Higgins, Kruse, and Piehl. Additional fire ecology information on hundreds of species is available in the Fire Effects Information System. This is a computer data base maintained by the federal government and is accessible through the Internet and the FWS Fire Management Home Page. The address of the FWS Fire Management Home Page is (<http://fire.r9.fws.gov>).

Uncontrolled wildfires have a potential for negative impacts on wildlife. Conversely, prescribed fire under the correct prescription can be used as a tool to improve habitat. The Complex has specific documentation of managing habitat with prescribed fire since 1980 (station files), and has station narratives describing prescribed fire as a management tool back into the 1960's.

## **K. Recreational Uses**

This area of North Dakota is rural and sparsely populated. Outdoor recreation, especially hunting, is a common activity. Hunting is the most common recreational use of Service lands in the Complex. Most WPAs are open to public hunting as specified in the Code of Federal Regulations and in accordance with State law. Arrowwood and Chase

Lake National Wildlife Refuge allows public hunting on portions of the refuge at times of the year when the use will not conflict with the primary purposes of the refuge.

Other outdoor activities allowed include hiking, photography, picnicking, bird watching and fishing. Refuge and other public use brochures are included as references for this document in Appendix I.

Recreational use and fire management can interact in several ways. Obviously the more recreational use the Complex receives, the greater the likelihood of human caused wildfire. Since the lands within the Complex fall under regulation by the State of North Dakota Rural Fire Suppression Plan, regulated by the North Dakota Fire Marshall's Office, some recreational activities may be eliminated or restricted when the fire danger rating in the area hits the very high to extreme categories. Appendix J contains a copy of the North Dakota plan titled "Procedures for Coordinating Rural Fire Suppression/Mitigation Measures".

Prescribed fire programs may also be limited by recreational use patterns. These are management decisions based upon public safety. It would be nearly impossible to check certain units to insure no hunters are caught inside the burn perimeter prior to burn execution. Other areas of the refuge must be carefully checked, roads and trails closed or other measures taken prior to a burn to insure recreational user safety is not compromised.

## **L. Improvements**

Wildfire damage to improvements on and off the Service land is a primary concern. While Service owned developments can generally be protected from fire damage, dispersed improvements, particularly fences, dikes and dams, predator exclosure barriers and adjacent private property is likely to be damaged by wildland fires. 95 percent of the land surrounding the Arrowwood NWR is under private ownership. Private improvements in these areas are numerous and are valued in the tens of millions of dollars. Crop, grazing, and haylands can have private resource values in excess of \$400.00 per acre, with thousands of acres in potential threat from wildfire originating on the Complex, especially during the late summer/early fall cured stage prior to harvest.

The majority of Complex structures are found at the headquarters area, but numerous small buildings, miles of fences and other improvements are located throughout the 9-county WMD's. The dispersed nature of the WMD's creates many situations where escaped prescribed fires or wildfires could damage adjacent private structures, equipment, and grazing/hay/cropland. Wildfire damage to other public property can occur to wooden utility poles and utility junction boxes which are located on or adjacent to Service lands. Private landowners generally have a low tolerance for wildfire, but the use of prescribed fire is fairly well accepted as a habitat management tool in most areas of the Complex. The Complex relies heavily on volunteer fire protection districts (RFD's) for suppression at remote WPA's, and also utilizes these resources to assist with wildland fire suppression on the Refuge. RFD's are relied upon to suppress structural fires on the Complex.



Table 4 contains a synopsis of the Complex's real property. This listing is a summary of real property lists for the Complex compiled by the Regional Realty Office in July of 2000, and is the most current list available. The complete real property list can be found in the files located at the Arrowwood NWR Headquarters building.

**TABLE 4**  
**ARROWWOOD NWR COMPLEX REAL PROPERTY INVENTORY SUMMARY**

<b>PROPERTY DESCRIPTION:</b>	<b># UNITS:</b>	<b>TOTAL VALUE: (\$)</b>
Pumphouse	2	33,000
Signs	3000	167,000
Bunkhouse (seasonal housing)	1	54,000
Dams	76	1,866,660
Dikes	25	1,424,000
Fences (boundary)	310 MI	9,266,400
Fences (predator exclosure)	7	703,000
Fire Cache	3	50,000
Fuel Storage	4	83,800
Garages (automobile)	6	408,657
Grain Bins	2	12,200
Headquarters Office	2	1,430,000
Headquarters Office (old)	1	110,000
Propane tanks	4	16,000
Canals	1	300,000
Culverts	1	102,000
Oil Shed	1	8,100
Public Restrooms - Outhouses	1	11,000
Radio Tower	1	13,900
Other Buildings	2	34,300
Shop Buildings	2	260,700
Staff Residences	2	700,000
Storage Buildings	3	115,000
Power Generating Facilities	1	3,000
Visitor Contact Stations	3	105,700
Water Control Structures	17	1,886,800
Water Plant	1	10,200
Weather Station (RAWS)	1	17,000
<b>REAL PROPERTY TOTALS:</b>	<b>170</b>	<b>\$19,786,600.00</b>

**Real Property Totals: 170 improvements/310 miles of fence  
\$19,786,600 TOTAL VALUE**

## **M. Wilderness**

Arrowwood Complex has 4,155 acres of wilderness located within the 4,385 acre Chase Lake NWR, established in 1975 by Public Law 93-632. The Chase Lake Wilderness Management Plan (1988), the 1964 Wilderness Act (16USC 1131) and FWS Refuge Manual 6 RM 8.8, Administrative Guidelines, Wilderness Management provide policy and guidelines for the management of the Chase Lake Wilderness. Consistent with this policy, Arrowwood Complex will closely adhere to the "light hand on the land" concept during actions taken to suppress wildfires with the wilderness area.

## **N. Air Quality/Smoke Management**

The management of smoke is incorporated into the planning of prescribed fires, and to the extent possible, in suppression of wildfires. The Chase Lake NWR is a Wilderness Area and a Class 1 airshed which does not limit the use of prescribed fire. Information on Class 1 airsheds in Wilderness Areas can be found in the Refuge Manual 6 RM 8.8N. Sensitive areas are identified and precautions are taken to safeguard visitors and local residents. Smoke dispersal is a consideration in determining whether or not a prescribed burn is within prescription. Generally the fine grass fuels and small burn size (80-600 acres) generates low volumes of smoke for short durations (4-5 hours).

Fire management activities which result in the discharge of pollutants (smoke, carbon monoxide, particulates, and other pollutants from fires) are subject to and must comply with all applicable Federal, State, and local air pollution control requirements as specified by Section 118 of the Clean Air Act, as amended 1990.

The North Dakota State Department of Health, Environmental Health Section implements the requirements of the Clean Air Act. Permits for open burning are required under the authority of the North Dakota Air Pollution Control Rules (Article 33-15, North Dakota Administrative Code). Written requests are submitted by the Complex to the Department of Environmental Health for each planned prescribed burn. Requests must identify acres, location, approximate date and purpose of the burn. The State grants approval in letter form and also notifies local and district Environmental Health Practitioners. **Appendix K** contains a copy of the state of North Dakota Conditions/Restrictions Applicable to an Approval to Open Burn, and specific burn request forms to be submitted during the permit application process. Smoke complaints are also investigated by the State Department of Environmental Health. To date the State has received no complaints concerning smoke from prescribed fires or wildfires on Complex lands. Complex personnel also take special care to notify neighbors, fire departments, and local law enforcement agencies on burn day. These actions are specific requirements of individual burn plans, incorporated into the plan both in the planning document and with an attached phone contact listing.

Currently the State of North Dakota recognizes two categories of prescribed fire. Separate legislation addresses prescribed fire by state and federal land management agencies, and prescribed fire use by private citizens for agricultural burning. The stipulations for these two types of burning are quite different, with regulations almost non-existent in the private sector and quite stringent for governmental agencies. Efforts are currently underway to equalize this problem to enable all burn practitioners in the state to function under the same set of rules.

Due to the lack of smoke management regulations for private citizens, conflicts can arise pertaining to smoke complaints leveled against the Service but which are actually the result of private agricultural burning. Since we are mandated by the burn planning process to inform our neighbors when we are going to conduct a prescribed burn, often these individuals will think all the smoke in their area is coming from our burn. Fire management personnel at the Complex must be aware of this potential problem and document any probable conflict situations as they occur. The occurrence of other ongoing prescribed burns in the area and corresponding smoke trajectory and potential impacts should be documented by written text or photographs while the burn is ongoing. Fire weather and smoke management observations on Complex burns should be documented hourly while the burn is in progress. Fire management personnel should also work with their local RFD's, State and local Government Agencies, and area neighbors to insure a better understanding of smoke management policy and mitigation techniques.

Smoke from wildfires and prescribed fires is also a recognized health concern for firefighters. Prescribed burn bosses and wildfire incident commanders must plan to minimize exposure to heavy smoke to one hour or less, at which time the employee should be rotated to a smoke free area (USDA Forest Service, Missoula Technology and Development Center).

## **O. Complex Fire Environment and History**

The Complex totals approximately 87,000 acres of fee title lands. Approximately 35% of this land, or 30,000 acres is comprised of a variety of seasonal and permanent wetlands. Most of these wetlands contain heavy fuel loadings of emergent vegetation including bulrush, cattail and other vegetation that when cured, will support a fire even over the top of the water. During dry years, many of these areas will completely dry up, burning with moderate to high fire behavior characteristics. Due to these factors, the total estimated burnable acreage for the Complex is 73,950 acres, or 85% of the total Complex acreage.

### **1. Fuel Types:**

Fuel models found within the Arrowwood NWR Complex are varied and include all four fuel groups (grass, shrub, timber and slash). Fuel modeling in wildland fire management has traditionally been accomplished using two fire behavior fuel model definition systems. The National Fire Danger Rating System (NFDRS) is comprised of 20 alphabetical models including A,L,S,C,T,N (grass models), B,O,F,Q,D (shrub models), H,R,U,P,E,G (timber models) and K,J,I (slash models). This modeling system is used in the NFDRS system to predict fire danger indices, and is also utilized in the FireBase system, the Service's computer based fire management budgetary system used to allocate wildland fire management resources. NFDRS fuel models are listed below for Complex lands.

A second system of wildland fire management fuel models has been developed for use in predicting fire behavior. This fuel model system is known as the Northern Forest Fire Laboratory or NFFL system. This fuel model system is also known as the FBO, or Fire Behavior Officer system. The NFFL or FBO system is used in running the BEHAVE computer program for estimating fire behavior, and is the fuel model used in Service prescribed fire plans. The NFFL fuel model system contains 13 fuel models numbered from one to 13, and broken into the

same four fuel groups as the NFDRS models.

NFFL fuel models are listed below concurrently with NFDRS models, and a listing of these models can be found in the National Wildfire Coordinating Group (NWCG) General Technical Report #INT-122, "Aids to Determining Fuel Models For Estimating Fire Behavior" (Anderson 1982). Page 18 of this publication also contains a comparison table showing NFDRS and NFFL fuel models and their relationships. A copy of this technical report has been included in Appendix L. Here is a breakdown of these groups, individual fuel models and their occurrence and characteristics on Complex lands.

**NFDRS Fuel Model L** (western annual/perennial grasslands; NFFL fuel model 1) Approximately 40,628 acres of the total burnable acres fit fuel model L. This model includes a variety of grasslands including savannas, cured cropland, stubble, short to medium height grasses and grass-shrub combinations. Perennial and annual grasses are the primary fuel, loadings are heavier than model A (annual grasses), and the fuel quantity is more stable from year to year. Decomposition rates of grass fuels are slow which leads to heavier than natural fuel loadings if fire is absent. Invading woody plants are mixed in the grasses throughout 30-50% of the units. This fuel model also fits some of the adjacent private lands including cured cropland, native prairie, grazed pastures and hayland.

**NFDRS Fuel Model N** (tall grass; NFFL fuel model 3): Approximately 38,271 acres of the Complex fit fuel model N. Described as tall grass, perennial grasses, and or marshland grasses approximately 3 feet tall, one third of the aerial portion of the plant is usually dead. Invading woody plants are mixed with these fuels throughout 10-40% of many of the upland areas. Areas of the Complex fitting this fuel model include heavy tall grass vegetation found in seasonal basins, meadows, marshes (bullrush and cattail) and areas planted into dense nesting cover (DNC). This fuel model also fits adjacent private lands including some uncut hay fields, wetland basins and marsh vegetation, and areas enrolled in the Conservation Reserve Program (CRP). CRP is a major concern for fire suppression agencies in this area. CRP acres have risen in recent years, and currently total 602,494 acres in the 9-county Complex (Barnes County - 102,599, Cass County - 29,970, Eddy County - 73,787, Foster County - 28,771, Griggs County - 85,028, Steele County - 22,691, Stutsman County - 181,843, Traill County - 6,841, and Wells County - 70,964 {2000 NRCS data}).

**NFDRS Fuel Model E/R** (hardwood leaf litter; NFFL fuel model 8/9): Approximately 154 acres of the Complex fit this fuel model. These areas usually are fairly fire resistant during the summer growing season (represented by NFFL model R and NFFL model 8), but can show explosive fire behavior including long distance spotting during the spring and fall months (NFDRS model E/NFFL model 9). Many of these areas are also in terrain that greatly limits access by fire equipment, and the combination of extreme fire behavior and inaccessibility often require indirect attack methods to be used.

**NFDRS Fuel Model G** (timber and litter with heavy dead and downed fuels present; NFFL fuel model 10): 100 acres of the Complex fit this model and are composed of overmature Bur Oak stands and areas of riparian gallery forest (Dutch Elm Disease) with high

to extreme loadings of dead and downed fuels in the 100 and 1000 hour size category. This model is found only in the Picnic area and along the west side of Jim Lake. Suppression of this model is difficult and requires an indirect attack under most circumstances.

**NFDRS Fuel Model F** (intermediate brush, NFFL fuel models 5 and 6): The Complex contains approximately 2,000 acres of brushlands that fit these fuel models. Fuels include stands of young elm and ash, mixed hardwood brush, snowberry, and willow encroachment areas found in former meadows and along riparian zones. Fuel model F (NFFL model 6) is represented by areas of willow encroachment and snowberry due to the flammable characteristics of this fuel. NFFL fuel model 5 best fits the remainder of this shrub type, including the young elm and ash and mixed hardwood brush areas. There is no NFDRS fuel model that corresponds directly to NFFL model 5, but NFDRS models F can be used as a second choice.

## **2. Fire Behavior**

Fire behavior runs have been completed for each NFFL fuel model on the Complex with the IBM PC based BEHAVE fire behavior prediction system. A variety of other non-standard fire prediction runs have also been completed for the Complex including dual fuel model runs (1 & 9). These BEHAVE runs are included in **Appendix M**.

**NFDRS Fuel Model L/NFFL Fuel Model 1:** (shortgrass) Represented by native prairie, tame grass and cropland in the Complex, fire spread is governed by the fine, very porous and continuous herbaceous fuels that have cured or are nearly cured. Fires are surface fires that move rapidly through the cured and nearly cured material. Fuel loading consists of mostly fine dead fuels in the 1 hour size category, but average 1.5-2 tons per acre. Fuel bed depth can reach a foot or greater, especially in areas that have not been burned in 10 or more years. Annual and perennial grasses are included, with very little shrub or timber present.

Fire behavior is directly related to the fine fuel moisture and wind speed. Spread rates with moderate to high wind speeds can reach 345 chains per hour (379.5 feet per minute), with flame lengths exceeding eight feet. Spot fires are generally not produced because fuels are consumed too quickly and thoroughly, although slopovers, organic soil combustion or fire whirls can cause control problems. Fire fronts tend to become irregular as topography, fuel loads, winds, and/or natural barriers speed up or slow movements. Resistance to control is low to moderate, depending on windspeed. Wildfire under high wind conditions often require indirect attack methods utilizing natural or human made barriers due to the intense rates of spread.

**NFDRS Fuel Model N/NFFL Fuel Model 3:** (tallgrass) This model displays the most intense fire behavior characteristics of the grass group, and is found as cattail/bullrush marshes and seasonal wetlands, DNC plantings, and CRP lands throughout the district. Indices include rates of spread under the influence of wind in excess of 530 chains per hour (583 feet per minute). Wind may drive fire into the upper heights of the grass and across standing water. Fuel loading consists of fine and coarse dead fuels, averaging 3 tons per acre, but can be in excess of

10 tons per acres in cattail areas. Flame lengths can exceed 28 feet, and fireline intensity can reach over 8,000 BTU/FT/S, higher than most timber and slash fuel models. Short range spotting (up to 500 feet) is common. Resistance to control is very high to extreme. Suppression response to wind driven fires in this fuel model will generally be limited to indirect attack methods.

Typically, wetland areas covered with fuel model 3 vegetation are not a significant fire factor during the spring high water period or during the growing season. During drought years or late in the season after the seasonal wetlands have dried, fire control difficulty in these zones can become both difficult and dangerous.

**NFDRS Fuel Model E/NFFL Fuel Model 9:** (hardwood litter). This model is typified by mixed hardwood stands and tree plantings in the Complex, and displays moderate to low fire intensity. Fires are carried by dead, loosely compacted leaves. Concentrations of dead downed woody material will contribute to more intense burning as well as moderate spotting. Fuels consist of mostly 1 hour size class comprising 2.9 tons per acre with a small amount of 10 and 100 hour fuels averaging 0.6 tons per acre. Spring and fall fires in this fuel model when crown cover is absent and leaves have fallen may exhibit higher rates of spread due to spotting caused by rolling and blowing leaves. Spread rates are generally slow, less than 60 chains per hour (66 feet per minute - wind driven). Flame lengths average 2-4 feet, but can reach up to seven feet under extreme conditions. Concentrations of dead and downed woody material can contribute to possible individual tree torching and spotting. Resistance to control is low to moderate except during drought conditions.

**NFDRS Fuel Model R/NFFL Fuel Model 8:** (hardwood litter - summer) This model generally exhibits slow burning ground fires with low flame lengths, although occasional heavy fuel areas can cause short term flare-ups. Typical fuels in this model found in the Complex are mixed hardwood forest stands after the trees have leafed out, shading the surface fuels. Fuels are composed of compacted litter layers and may have a fuel bed up to three inches thick. Little undergrowth is found in these stands, and fuel loadings average five tons per acre. This fuel model generally offers little difficulty of control unless severe weather conditions including high temperatures, low humidities and high winds are present.

**NFDRS Fuel Model G/NFFL Fuel Model 10:** (timber and litter with heavy downed fuel present) Represented by blowed down elm and ash in the Complex with high loadings of 100 and 1000 hour fuels, fires in this model burn with greater intensity than other timber-litter models. The Complex experienced a 100+ mph wind event in July of 1999 which caused numerous trees and shelterbelts to be destroyed. Dead and downed fuels include seven or more tons per acre of three inch or larger diameter limb wood and fallen trunks from over maturity, previous fire kill, or high wind events. Crowning out, torching and spotting is common, creating potential fire control difficulties. Under high winds and low fuel moisture conditions, rates of spread can

exceed 30 chains per hour (33 feet per minute), flame lengths can exceed nine feet, and fireline intensities can exceed 730 BTU/FT/S, well above the limits for control by direct attack.

**NFDRS Fuel Model F/NFFL Fuel Models 5 and 6:** Fuel model 6 is represented by western snowberry and willow in the Complex and fuel model 5 by mixed hardwood brush. Fire can be carried by the surface fuels only (#5) or by the surface fuels and shrub layer where the vegetation is more flammable (#6). Fuel model #5 is characterized by low intensity fire as surface fuel loads are light, shrubs are young with little dead material, and the composition of the living foliage is not volatile. Fuel model #6 contains greater loadings of 10 and 100 hour dead fuels and has more volatile vegetative characteristics. Combustion of the shrub layer usually required greater windspeeds, with fire dropping back to the surface when the winds diminish. Wind driven fire in fuel model 6 can reach rates of spread of 130+ chains per hour (143 feet per minute), flame lengths in excess of 11 feet and fireline intensities of over 1,000 BTU/FT/S, rendering direct attack impossible.

### **3. Fire Occurrence/History**

A search of fire history contained within the Occurrence System of the Service's Fire Management Information System from 1985 to the present shows a total of 50 wildfires within the Complex for an average of 3.1 per year. The majority of the wildfires were human caused (vehicles, arson, and negligence). In recent years the highest occurrence has been attributable to escaped agricultural burning adjacent to the refuge by private residents, with equipment malfunction and roadside burning a close second.

Historic records describe huge prairie fires started by lighting or humans (Pyne, 1982). Fires burned millions of acres as there were few natural fuel breaks and no suppression. Wright, et al. (1978) believe that fire frequency in the prairie grasslands is on the order of 5-10 years. Other studies indicate that a longer frequency of 10-20 years may be more accurate (T. Bragg 1995). Local data exists for the Complex back to the early 1970's. However, this data does not indicate historic fire occurrence or frequency due to the heavy agricultural utilization and fragmentation of the area since European settlement.

Wildland fire has been an integral part of the prairie ecosystem for thousands of years, removing dead vegetation, releasing nutrients, and suppressing woody plants. Pyne (1982) states that since human influence began shortly after the Wisconsin glaciation of 10,000 to 12,000 years ago, this area has been perpetuated in the mixed grass prairie primary successional stage, and Anthropogenic fire played a major role in this long term vegetative structuring.

Estimates of fire cause in the pre-settlement northern great plains based upon available vegetative history and early encounters of Europeans conclude that as much as 85% of the fire occurrence was anthropogenic, with the remaining 15% of fires started by lightning (Hough 1926; Sauer 1963; Journal of American History 1990; Pyne 1982). Anthropogenic fire starts concentrated on the period from March through June and July through December, with maximum use occurring in April and October (Pyne 1982). Anthropogenic fire also reduced the number and size of lightning ignitions due to the



increase of fire barriers (recently burned areas) and reduction of fuels.

Fire records of the Complex exist from 1970 to the present, however detailed information is lacking. Past records indicate that the area usually has a high number of annual wildfires. Many fires occur annually on the Complex that are either extinguished by local rural fire departments (RFD's), or are natural outs. We are confident that many more unreported wildfires have occurred on Complex lands than are included in the FMIS fire occurrence database. Most agricultural field burning occurs during the spring and fall. Private landowners are not subject to the same burning regulations as government agencies. Farm fields are often ignited and left unattended, sometimes resulting in wildfires. Many of the wildfires were suppressed either with the help of the RFD's or solely by them.

**TABLE 5**  
**ARROWWOOD NWR COMPLEX - WILDFIRE HISTORY 1985 TO 2000**

1985	0	0
1986	1	190
1987	3	193
1988	4	324
1989	1	82
1990	1	81
1991	1	10
1992	0	0

1993	0	0
1994	3	4,883
1995	2	39
1996	2	35
1997	2	14
1998	6	127
1999	16	430
2000	8	162
<b>TOTAL 1985-2000 **</b>	<b>50</b>	<b>6,570</b>

**\*\* 16 YEAR AVE.      3.1 fires/year      410.6 acres/year**  
**AVERAGE ACRES PER FIRE = 131.4**

**Appendix N** contains a detailed copy of all fire occurrence on the Arrowwood NWR Complex from 1986 through 2000.

#### **IV. FIRE MANAGEMENT GOALS AND OBJECTIVES**

The following considerations influenced the development of the Complex fire management goals and objectives. The previous sections of this plan have established that:

1. Fire was integral in shaping the native biotic communities within the Complex.
2. The absence of fire over the past 100 years has altered the natural landscape. Fire must be reintroduced on a landscape scale to rejuvenate native plant communities and associated animal species.
3. Positive or negative effects of prescribed fire on vegetation, wildlife, and cultural resources depend on burning conditions and plant phenology.
4. Uncontrolled wildland fire has the potential for negative impacts on and off Complex lands.
5. Rapid rates of fire spread, potentially long response times, and the large number of individual land units (WPA's) pose suppression problems and increase the likelihood of wildfire escape onto adjacent private lands.
6. Use of appropriate management responses that minimize environmental damage from suppression efforts is important throughout the Complex.

#### **A. Complex Fire Management Goals**

1. Protect life, property, and other resources from wildfire.
2. Use prescribed fire as a tool to accomplish habitat management objectives.
3. Maintain a wildland fire management program that is professional in nature and utilizes available resources both economically and efficiently.

#### **B. Complex Fire Management Objectives**

1. Safely suppress all wildland fires using appropriate management responses based on safety considerations, Complex objectives and values at risk.
2. Minimize the impact and cost of fire suppression activities through the professional use of preparedness processes.
3. Use prescribed fire for hazardous fuel reduction to the fullest extent possible within or near Complex development zones, wildfire sensitive resources, and boundary areas to reduce the risk from wildfire damage. Treating 3,000 acres yearly.
4. Restore fire to the Complex on a landscape scale through the use of prudent prescribed fire to restore and perpetuate native species and communities.
5. Maintain a diversity of healthy plant communities at various successional stages to provide suitable habitat for all grassland species through the use of prescribed fire.
6. Utilize prescribed fire to suppress and control exotic invader species such as leafy spurge, smooth brome and kentucky bluegrass. Treating 2,000 acres yearly.

7. Utilize prescribed fire to control woody plant invasion within the Complex. Treating 1,000 acres yearly.
8. Educate the public regarding the role of prescribed fire within the Complex.
9. Work with adjacent landowners and cooperators to increase the use of prescribed fire in the public and private sectors within the Complex's sphere of influence and to foster increased understanding and cooperation between all entities involved in wildland fire activities.
10. Provide wildland fire management support to other agencies to the extent possible within the interagency fire management support network.

## **V. FIRE MANAGEMENT STRATEGIES**

### **A. General:**

The Complex's wildland fire management program is based on the Departmental Manual, (620 DM 1-2), the Refuge Manual chapter 6 RM 7, and the Service's Fire Management Handbook. Every wildfire on or threatening refuge lands will be suppressed by using an appropriate management response. A wildland fire situation analysis (WFSA) will be prepared to govern suppression actions for all escaped fires when it is determined that initial attack efforts will be unsuccessful. **Figure 6** provides a decision flow chart that will be employed by management to assist with fire decision making on the Complex.

Fire management strategies will be based upon "appropriate management response". The definition of "appropriate management response" is "specific actions taken in response to a wildland fire to implement protection and fire use objectives." The Complex will utilize this appropriate management response strategy incorporating all pertinent aspects of this fire management plan to establish individual suppression guidelines for each wildland fire occurrence on Complex lands. Suppression actions may vary from high intensity direct attack efforts to lower intensity indirect attack efforts, including monitoring and surveillance to ensure confinement within a designated area utilizing natural and human made barriers when appropriate. The level of response will be consistent with land use objectives, and will be executed to minimize suppression costs and resource damage. **Table 6** outlines appropriate management response that will be utilized on the Complex.

The safety of personnel involved in suppression activities on refuge lands is of paramount concern. With the possible exception of instances where the life of another is threatened, no refuge employee, contractor, or cooperator will be purposely exposed to life-threatening conditions or situations.

Only trained and qualified people will be assigned to fire management duties. The Complex will adhere to qualification requirements listed in PMS 310-1, the NWCG Wildland Fire Qualifications Guide, and those agency specific qualifications guidelines outlined in the Service's Fire Management Handbook, the Departmental Manual (620 DM 1-2), and the Refuge Manual chapter 6 RM 7. All fire management personnel will be issued required personal protective equipment (PPE) and will be

trained in its proper use. Staff members utilized in wildland fire operations are required to pass a pack test. Staff members utilized in prescribed fire operations are required to pass a field test. All staff members used in any fire operations will attend a Standards For Survival refresher course each year.



**Table 6: Appropriate Management Response**

SITUATION	STRATEGY	TACTIC
1. Wildland fire on Refuge lands which does not threaten life, natural resources or property values.	Restrict the fire within defined boundaries established either prior to the fire or during the fire.	1. Holding at natural and man-made barriers. 2. Burning out. 3. Observe and patrol.
1. Wildland fire on Service property with low values at risk. 2. Wildland fire burning on to Service lands. 3. Escaped Prescribed fire entering another unit to be burned.	Take suppression action, as needed, which can reasonably be expected to check the spread of the fire under prevailing conditions.	1. Direct and indirect line construction. 2. Use of natural and man-made barriers. 3. Burning out. 4. Patrol and Mop-up of fire perimeter.
1. Wildfire that threaten life, property or sensitive resources. 2. Wildfire on Service property with high values at risk. 3. Observed and/or forecasted extreme fire behavior.	Aggressively suppress the fire using direct or indirect attack methods, holding the fire to the fewest acres burned as possible.	1. Direct line construction. 2. Engines and Water Use. 3. Aerial retardant. 4. Burning out and back fires. 5. Mop-up all or part of the fire area.

**B. Specific Fire Management Strategies:**

The following will be employed to meet fire management objectives.

1. Suppress all wildfires in a safe and cost effective manner consistent with resources and values at risk utilizing appropriate management response. Minimum impact strategies and tactics will be used when possible.
2. Conduct all wildland fire management programs in a manner consistent with applicable laws, policies and regulations.
3. Cooperative fire agreements (MOU's) with state, federal and local fire agencies will be maintained to provide for cooperative suppression actions and ensure reimbursement is appropriately made. The Complex will provide assistance to local or federal cooperators under the "closest resources" and "total mobility" principles in accordance with Service policy.

4. Initial attack (IA) on lands within the Complex will be the primary responsibility of Complex fire management resources. Rural fire departments (RFD's) will be used to supplement Complex IA resources when necessary. Mutual Aid Agreements (MOU'S) with local RFD's to support IA actions on Service lands will be reviewed on a yearly basis and renewed as needed.

5. MOU's with local RFD's will also be used to establish structural fire suppression capabilities in areas of the Complex where significant structural improvements are present. Complex wildland fire suppression resources do not have the training or equipment to safely suppress structural fires. Complex resources can be used to protect structural improvements from wildland fire, for external suppression efforts where deemed safe and consistent with personnel training and qualifications, and can be used to support RFD structural suppression resources where feasible, but Complex wildland fire resources will not be utilized in any internal structural fire suppression operations.

6. Due to the wide-spread land holdings within the Complex (9 counties, 238 units), RFD's will be utilized for initial attack on wildfires in remote areas. Complex initial attack equipment and personnel will be dispatched to all reported wildfires within the Complex, and will assume responsibility of the incident upon their arrival. Wildfires escaping onto state or private lands will be managed under a unified command system with local fire management agencies. Unified command structure will be fire specific and will be established on site based upon resources available and fire situation.

7. Prescribed fire will be utilized as a management tool for achieving hazard fuel and resource management objectives. To the greatest extent possible, hazard fuel prescribed fires will be used only when they can compliment resource management objectives.

8. Cost effective fire monitoring will be initiated to provide a mechanism for managers to determine if objectives are being met. Monitoring programs will be coordinated between the fire management staff, refuge manager and staff biologist. Monitoring programs will include both short and long term processes, and will incorporate all previously available fire ecology information.

9. Heavy equipment (dozers, discs, plows, and graders) will not be used for fire suppression on Complex lands except in situations threatening life or property without the approval of the Project Leader, Supervisory ROS, ROS, Refuge Manager, or their designated representative.



## **VI. FIRE MANAGEMENT UNITS**

The Complex will be broken up into two types of units; wildfire management units and prescribed fire management units.

### **A. Wildfire Management Units:**

Consistent with FWS policy all wildland fires will be suppressed utilizing an appropriate management response. This response may vary including direct attack, indirect attack or monitoring and surveillance.

The Complex is divided into three wildfire management units based upon fuel type, topography, accessibility of fire management resources, and average response time. These three units are 1) Arrowwood NWR 2) Chase Lake NWR and 3) Complex WMD's. Figure 7 provides a map outline of the Complex's wildfire management units.

Complex fire management resources are located at each office. These resources will be dispatched to each unit as necessary for preparedness and initial attack actions.

#### **1. Arrowwood NWR:**

The Arrowwood refuge is located in Stutsman County. The Refuge unit includes the refuge headquarters and is characterized primarily by fuel models 1, 3 and 5. Initial attack response in this unit will primarily be conducted by Complex fire management staff and equipment.

The Refuge Unit is very accessible due to refuge trails and gravel roads. There are numerous natural and human made barriers that assist in suppression actions including cropland, roads, heavily grazed pasture, hayland, and the James River system. Due to the close proximity to private property, values at risk along the border of the unit are many. The potential for wildfire to move on or off refuge lands in this unit is great due to the elongated and narrow nature of the Refuge. IA response in this area will include both direct and indirect attack dependant upon weather and fuel conditions, topography, management objectives and values at risk. Monitoring or surveillance may also be used in some areas of this unit, but these are few and far between and would consist almost entirely of fire in marsh areas that are inaccessible to suppression forces and are separated from upland areas by open water or mud flats.

#### **2. Chase Lake NWR:**

The Chase Lake NWR Unit is located in Stutsman County. A major portion of the Chase Lake NWR unit is also a Wilderness Area. It is characterized primarily by fuel model 1 and 3. Initial attack response in the unit will be conducted by Complex fire management staff. Initial attack response on some portions of the unit will be conducted by RFD's due to excessive response time by Complex staff.

This area poses significant wildfire control problems and heightened holding needs during prescribed burning. Access by fire equipment is somewhat limited. Many acres of native prairie and CRP are located adjacent to the unit.

Typical initial attack strategies in this unit will include both direct attack and indirect attack dependant upon weather and fuel conditions, topography, management objectives and values at risk. Monitoring or surveillance may also be used in some areas of this unit, but these are few and far between and would consist almost entirely of fire in marsh areas that are inaccessible to suppression forces and are separated from upland areas by open water or mud flats.

### **3. Wetland Management Districts:**

This unit incorporates a total of 232 Waterfowl Production Areas (WPA's) scattered throughout 9 counties and totaling over 64,211 acres of fee title lands. Due to the fragmented nature of this unit and the excessive response time to many of the individual WPA's, initial attack response in this unit is primarily supplied by local RFD units.

Risk of wildfires or prescribed fires escaping from refuge lands in the WMD is moderate to high. Farming, grazing and wetlands create barriers to fire spread in some areas. Access for light and medium engines is fair considering slope, wetlands, rocks, and limited access roads or trails. The rugged nature of the topography requires specific "local" knowledge of access routes for fire suppression actions throughout refuge and adjacent lands. Many of the boundary lines for refuge units are conducive to fire spread onto private land due to topography.

Fuel models vary widely throughout the unit, with the majority of lands coming under fuel models 1 and 3. Suppression strategies, management restrictions, fuels, fire environments, and values at risk are similar throughout the WMD Unit. Complex resources will be dispatched to any fire reported on or threatening WMD lands, although often wildfires are extinguished by local RFD's in this unit before we are notified that a fire exists.

Initial attack strategies in this unit will predominantly be direct and indirect attack. These areas are typically small, isolated units surrounded by section line roads, cropland, grazed pasture and haylands. Fire would benefit most of these areas, and indirect attack along the unit borders may be the preferred method of control. In areas of high public scrutiny or with high adjacent values at risk, a direct attack would be preferred. Monitoring or surveillance is a limited option in this unit due to surrounding private property, but isolated areas surrounded by water or marsh areas sealed off from uplands by open water or mud flats may be conducive to this management strategy.

## FIGURE 7 WILDFIRE MGMT UNITS

## **B. Prescribed Fire Management Units:**

The Complex has been separated into seven main zones for prescribed fire purposes based upon current management. Zones are separated into lands administered by the Arrowwood NWR and those administered by each WMD office. Management units have been further delineated within each zone by location.

### **1. Arrowwood NWR Zone:**

The refuge has been broken up into 4 management units including the Arrowwood Lake unit, Mud Lake unit, Jim Lake unit, DePuy Marsh unit. Much of the upland burnable acreage in these management units has been divided into individual burn units.

Currently the refuge has a total of 73 individual burn units identified totaling 15,934 acres. Prescribed burn plans have been completed for most of these units to date, with work ongoing on the remainder. One goal of the fire management program is to have all possible areas of the refuge that may be treated with prescribed fire identified and prescribed burn plans completed and approved within the next three years. Prescribed fire management units within the Arrowwood NWR Zone are listed below. **Figure 8** depicts the Arrowwood NWR zone and associated management and prescribed burn units.

**FIGURE 8 PRESCRIBED BURN MANAGEMENT UNITS**

**Figure 8a - Arrowwood Lake**

**Figure 8b - Mud Lake**

Figure 8c - Jim Lake



**Figure 8d - Depuy Marsh**

**Figure 8e - Complex WMD's**

**a) Arrowwood Lake Management Unit:**

This management unit encompasses the north end of the refuge. The Arrowwood Lake Management Unit includes 19 burn units totaling 3,057 acres. Individual prescribed burn units contained within the Arrowwood Lake Management Unit are listed in Table 7.

<b>TABLE 7</b> <b>PRESCRIBED BURN UNITS OF THE ARROWWOOD LAKE MANAGEMENT UNIT</b>	
Unit Name:	Total Acres:
F-1	180
G-9	222
G-8	258
G-7	134
D-3	83
G-6	233
D-2	120
G-5	142
F-3	47
B-3	167
G-1	168
D-1	160
G-2	194
G-4	166
G-3	142
B-1	166
B-2	256
G-1a	90
F-2	129
<b>TOTAL ACREAGE</b>	<b>3,057</b>

**b) Mud Lake Management Unit:**

The Mud Lake Management Unit includes 28 prescribed burn units totaling 3,920 acres. Individual prescribed burn units contained within the Mud Lake Management Unit are listed in Table 8.

<b>TABLE 8 PRESCRIBED BURN UNITS OF THE MUD LAKE MANAGEMENT UNIT</b>	
<b>Unit Name:</b>	<b>Total Acres:</b>
G-20	105
G-18	304
G-15	144
D-6	169
B-4	138
D-7	276
G-16	180
D-5	103
G-12a	191
D-5a	17
G-11b	33
G-10a	233
G-10b	80
G-10c	87
G-11a	328
D-8	47
G-12b	49
F-5	155
G-12d	82
G-12c	36
G-14	297
D-4a	40
D-4b	59
G-19	358
F-3	35
G-17	170
D-4	130
G-13	74

<b>TOTAL ACREAGE</b>	<b>3,920</b>
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**c) Jim Lake Management Unit:**

The Jim Lake Management Unit includes 17 prescribed burn units totaling 3,353 acres. Individual prescribed burn units contained within the Jim Lake Management Unit are listed in Table 9.

<b>TABLE 9</b> <b>PRESCRIBED BURN UNITS OF THE JIM LAKE MANAGEMENT UNIT</b>	
<b>Unit Name:</b>	<b>Total Acres:</b>
D-13a	267
D-13b	118
F-6	40
D-12	287
D-11	328
F-7	168
G-26	305
G-25	381
D-10	244
G-24	97
G-27	237
G-23	223
D-9	125
G-22b	39
G-22c	143
G-22a	73
G-21	278
<b>TOTAL ACREAGE</b>	<b>3,353</b>

**d) Depuy Marsh Management Unit:**

The Depuy Marsh Management Unit includes 8 prescribed burn units totaling 1,441 acres. The management unit encompasses the south end of the refuge. Individual prescribed burn units contained within the Depuy Marsh Management Unit are listed in Table 10.

<b>TABLE 10 PRESCRIBED BURN UNITS OF THE DEPUY MARSH MANAGEMENT UNIT</b>	
<b>Unit Name:</b>	<b>Total Acres:</b>
D-16a	126
D-16b	130
D-16c	65
B-6	234
F-8	166
G-29	185
G-28	182
D-14	125
D-15	65
G-30	163
<b>TOTAL ACREAGE</b>	<b>1,441</b>

**2. Arrowwood NWR Complex WMD Zone:**

The Arrowwood NWR Complex WMD Zone is divided into three management units for prescribed fire purposes. These management units are divided by each WMD office. The management units are as follows; Valley City WMD, Chase Lake NWR/WMD, and Arrowwood WMD. Chase Lake NWR has been combined with the WMD. There are a total of 232 Waterfowl Production Areas (WPA's) within the WMD's, totaling 64,211 acres with 5 Wildlife Development Areas (WDA's) totaling 3,797. Due to the small average size of these WPA's, normally a single plan will be written to cover prescribed burning an entire WPA. Fire managers can burn the entire WPA, or can subdivide the WPA into smaller units, burning a certain amount of acreage at a time per management discretion. Currently, plans have been written and approved for approximately 25% of the WPA's. Within the next three years, plans for the majority of WPA units should be completed. Table 11 provides a breakdown of WPA's by county per WMD.

TABLE 11 WPA BREAKDOWN PER COUNTY WITHIN EACH WMD			
WMD OFFICE:	COUNTY:	TOTAL NUMBER OF WPA'S:	TOTAL ACRES:
Chase Lake	Stutsman	95*	32,813*
	Wells	38**	10,836**
Arrowwood	Foster	9	1,495
	Eddy	19	4,657
Valley City	Steele	11	3,291
	Griggs	17	3,357
	Barnes	38	7,421***
	Cass	6	3,426
	Traill	4	712
TOTALS:		238	68,008

\*Includes Chase Lake NWR and 1 WDA.

\*\*Includes 4 WDA's.

\*\*\*Includes Stoney Slough NWR.

Figures 3, 4, and 5 show maps of the individual WPA's located within each of the nine counties covered by the WMD's. Appendix O contains the Complex WMD's prescribed fire management units listing each WPA, acreage, prescribed burn priority, required burning period, and current burn plan status. This appendix will be updated yearly to maintain currency of this Fire Management plan.

## **VII. FIRE MANAGEMENT ORGANIZATION AND RESPONSIBILITIES**

### **A. Current Fire Management Organization:**

Wildfire assignments are made on the basis of individual qualifications and position requirements. The Complex fire management organization is comprised of permanent and seasonal fire staff including the Complex Fire Management Officer (FMO) and the seasonal fire crew. Other non-fire staff are also important members of the Complex fire organization including the Refuge Manager, Supervisory ROS, ROS, Complex Biologist, Administrative Officer, Biological Technician, Engine Equipment Operator, Maintenance Worker, Clerk (OA), and other seasonal station employees. Table 12 details the present fire management staffing allotted to the Complex, and the ideal fire management staffing plan as determined by Complex management based upon present and anticipated fire management workloads and FireBase analysis runs.

The following pages describe the duties and responsibilities of Complex staff involved with fire management operations.

#### **1. Complex Fire Management Officer:**

The Complex FMO is responsible for oversight of the Complex and prescribed fire district fire management operations. The prescribed fire district includes the Arrowwood NWR Complex (Arrowwood NWR/WMD, Chase Lake NWR/WMD, and Valley City WMD) and the Long Lake NWR Complex. Complex fire staff have prescribed fire support responsibilities for these stations. The FMO is supervised by the Arrowwood WMD ROS. This is a secondary firefighter position for fire retirement purposes. Duties of the Complex FMO are listed below.

- \* Responsible for fire management program oversight for the Complex, and prescribed fire management assistance in the Arrowwood NWR Complex prescribed fire district.
- \* Insures that Department, Service, and Regional fire management policies are maintained and followed.
- \* Within budgetary limitations, sufficient collateral duty firefighters meeting Service standards are available for initial attack.
- \* Responsible for insuring the maintenance and readiness of Complex fire vehicles, equipment and supplies.
- \* Supervises fire management activities on land management units within the Complex.
- \* Responsible for oversight of Complex prescribed fire program including the planning, preparation, and implementation of prescribed burns. Reviews all prescribed burn plans for the Complex. Serves as prescribed burn boss, proposes annual hazard fuel reduction and resource management prescribed fire projects, tracks budgets and spending on all prescribed fire accounts, and completes individual fire reports (DI-1202) and yearly fire accomplishment reports.



- \* Responsible for planning, coordinating, and directing Complex fire preparedness activities including:
  - fire training
  - step-up plan
  - physical fitness testing
  - fire weather station operation
  - fire cache and equipment inventories
  - insures step up plan is followed
  - coordinates with cooperating fire agencies
  - prepares annual FireBase budget request, approves and tracks use of Firebase accounts.
- \* Provides supervision to the Complex FPT, establishes work priorities for the seasonal fire management staff based upon input from the Refuge Manager, Supervisory ROS, ROS, Complex Biologist and relates these priorities to the Fire Program Technician(FPT). The FPT is responsible for running the daily operations of the seasonal fire crew.
- \* Prepares Complex fire prevention plan, and coordinates fire prevention with other employees.
- \* Maintains liaison with Regional Fire Management Coordinator and Zone Fire Management Officer.
- \* Updates the Complex Fire Management Plan, maintains fire records, and reviews fire reports for accuracy.
- \* Assists Complex biologist in development and implementation of Complex fire monitoring program to determine if resource management prescribed fires accomplish objectives.

## **2. Complex Fire Program Technician:**

The Complex is currently staffed with a Fire Program Technician (FPT). This position is responsible for daily supervision of the Complex temporary/seasonal fire crew, and interacts closely with all Complex staff in fire management and project work. This is a primary firefighter position for fire retirement purposes. Duties of the FPT are listed below.

- \* The FPT has daily supervisory responsibility of the Complex fire crew, plans and directs daily work assignments, sets work priorities based upon direction of FMO, refuge and district managers and staff biologist.
- \* Provides training and guidance to seasonal fire staff. Ensures training and experience occurrences are made available to staff to provide upward mobility opportunities, developing professionalism of employees.
- \* Responsible for maintenance of issued personal protective equipment and physical conditioning.
- \* Must qualify annually on the fire management physical fitness Pack Test.
- \* Maintains accurate records and documentation in support of fire management operations.

- \* Knows and adheres to Service and interagency fire management policy. Instructs subordinates in these issues.
- \* Operates station fire engines, water tenders, ATV's, firing devices, chainsaws, pumps, foam systems and other specialized fire equipment during wildfire and prescribed burning assignments safely and within Service and fire management standard operating procedures. Trains subordinates in the operation and maintenance of same.
- \* Insures fire staff maintains fire equipment and personal fire gear in a fire ready condition at all times. Supervises the performance of weekly equipment checks for fire pumps, chainsaws, engines, foam systems, fire hand tools and other specialized fire equipment and supplies, and documents checks per station guidelines.
- \* Supervises and instructs subordinates in the operation of tractors, mowers, discs, rakes and other implements in construction and maintenance of firebreaks for wildfire preparedness, prescribed fire and other refuge programs.
- \* Provides assistance with biological monitoring, resource management and other refuge projects to enhance the productivity of refuge operations.

### **3. Complex Biologist:**

- \* Responsible for biological program management on the Complex including determining areas and correct timing for prescribed fire implementation. Works closely with the FMO to establish yearly prescribed burn targets.
- \* Provides technical guidance for all resource management activities on land management units within the Complex including the selection of objectives and tools to be used in achieving objectives (including prescribed fire).
- \* Provides support of fire management line operations including wildfire suppression and prescribed burning as qualified.
- \* Coordinates fire monitoring program to determine if resource management prescribed fires accomplish objectives. Establishes monitoring protocols and conducts research in support of fire management operations.
- \* Reviews all proposed units to be burned to ensure sound biological principles are being followed, resource management objectives are valid, and sensitive resources are not being negatively impacted.

#### **4. Refuge Manager/Supervisory ROS/ROS**

The Complex Management Team and/or their designated representative (refuge or district manager) is responsible for the following fire management program elements.

- \* Responsible for the overall management of the Complex including the fire program.
- \* Insures that Department, Service, and Regional fire management policies are maintained and followed.
- \* Supervises the resource management activities on land management units within the Complex including the selection of objectives and tools to be used in achieving objectives (including prescribed fire).
- \* Supervises the Complex fire management officer.
- \* Insures tracking of fire management budgets are conducted in an accurate and timely fashion. Approves spending of fire funds and insures fire dollars are utilized in accordance with regional and national guidance.
- \* Maintains liaison with Regional Fire Management Coordinator, Zone Fire Management Officer, and North Dakota Interagency Dispatch Center and Fire cache operations.
- \* Reviews and approves fire management budget request submissions, prescribed burn plans, Fire Management Plan updates, and other fire management planning documents. Performs as approving official for prescribed burn plans within the "low to normal" complexity category.
- \* Insures fire monitoring programs provide the level of monitoring to support fire management operations. Supervises and provides direction to Complex biologist.

#### **5. Career-Seasonal, Seasonal and Collateral Duty Firefighters:**

This includes temporary/career-seasonal firefighters hired by the Complex during the fire season (usually from early April through early November), other non-fire seasonal employees hired by the complex, and permanent non-fire funded Complex employees not listed in the above sections.

- \* Responsible for maintenance of issued personal protective equipment and physical conditioning.
- \* Qualify annually on the Pack Test, Field Test or Walk Test before May 1, or within 2 weeks of EOD date.
- \* Assist Supervisors in maintaining accurate records.
- \* Know and adhere to Service and interagency fire management policy. Act professionally on all fire management details

- \* Operates station fire engines, water tenders, ATV's, firing devices, chainsaws, pumps, foam systems and other specialized fire equipment during wildfire and prescribed burning assignments safely and within Service and fire management standard operating procedures.
- \* Maintains fire equipment and personal fire gear (PPE and equipment) continuously insuring a fire ready condition at all times. Performs weekly equipment checks for fire pumps, chainsaws, engines, foam systems, fire hand tools and other specialized fire equipment and supplies and documents checks per station guidelines.
- \* Operates tractors, mowers, discs, rakes and other implements in constructing and maintaining firebreaks for wildfire preparedness, prescribed fire and other refuge programs in a safe and effective manner.
- \* Work performed as a member of the station firefighting crew as qualified on preparedness, wildfire suppression and prescribed burning projects is conducted safely and within established fire management guidelines.
- \* Provides assistance with biological monitoring, resource management and other refuge projects to enhance the productivity of refuge operations.
- \* At times may act as crew foreman during daily fire management and refuge project work. Assists in ordering, storage, maintenance and inventory of fire cache equipment and supplies.

## B. Complex Fire Management Staffing Needs

**Table 12** depicts the current fire management staffing and predicted fire staffing needs for the Complex to fully support wildland fire and prescribed fire programs based upon management goals and objectives. This list was derived from analysis runs in the FireBase budgetary program and through workload analysis by Complex management.

**TABLE 12  
COMPLEX FIRE MANAGEMENT STAFFING**

Position Name:	Grade Level:	# Pay Periods:	Current Staffing: (# positions)	Ideal Staffing: (# positions)
Complex Fire Management Officer	GS-09	26	1	1
Fire Program Technician	GS-07	26	1	1
Career-Seasonal Range Technician	GS-04,05	13	2	3
Seasonal Firefighter	GS-3/4/5	13	4	6

**Figure 9** flow chart represents the current Complex fire management staffing plan and supervisory chain of command.

**Figure 10** depicts the planned flow chart given full fire management staffing levels for the Complex.





**C. Minimum NWCG Position Requirements:**

The National Wildfire Coordinating Group (NWCG) establishes fire position qualifications for all NWCG member agencies including the FWS, National Park Service (NPS), Bureau of Land Management (BLM), Bureau of Indian Affairs (BIA), and the US Forest Service (USFS). Qualifications are based upon fire training and experience requirements. The Service maintains a database of employee fire qualifications and experience that utilizes NWCG guidelines. NWCG fire position qualification requirements can be found in the NWCG 310-1 publication. Copies of 310-1 are kept in the Complex fire management office. In order to support Complex fire operations, minimum NWCG qualified position requirements have been identified. This information is available in **Table 13**.

<b>TABLE 13 COMPLEX NWCG POSITION REQUIREMENTS</b>		
<b>Position Name:</b>	<b>NWCG Mnemonics:</b>	<b>Number Required:</b>
Incident Commander Type 5	ICT5	2
Incident Commander Type 4	ICT4	1
Prescribed Burn Boss Type 3	RXB3	3
Prescribed Burn Boss Type 2	RXB2	1
Strike Team Leader - Engine	STEN	1
Single Resource Boss - Engine	ENGB	3
Single Resource Boss - Crew	CRWB	1



Engine Operator	ENOP	4
Prescribed Fire Ignition Specialist	RXI2	2
Firefighter Type 1 - Squad Boss	FFT1	2
Firefighter Type 2	FFT2	6

The NWCG also publishes guidelines establishing standard duties and responsibilities for fire personnel involved in the management of wildfires and prescribed burns. This information is available in the NWCG Fireline Handbook (PMS 410-1) and in the current NWCG taskbooks for all NWCG fire management positions. The PMS 410-1 and corresponding position taskbooks are on file in the Complex fire management offices. A short outline of duties and responsibilities for critical NWCG positions is included below.

#### **1. Wildfire Incident Commander:**

- \* The incident commander (IC) will be responsible for the safe and efficient suppression of the assigned wildfire.
- \* Fulfill the duties described for the IC in the Fireline Handbook (PMS 410-1).
- \* Ensure that personnel are qualified for the job they are doing.
- \* Submit information needed to complete the DI-1202 (fire report) to the Regional Fire Management Coordinator within 10 days of the fire being out.

#### **2. Prescribed Burn Boss:**

- \* Implement approved prescribed burn plans within prescriptions.
- \* Assist with the administration, monitoring, and evaluation of prescribed burns.
- \* Document necessary information to complete DI-1202 (fire report) and submit to Regional Fire Management Coordinator within 10 days of the fire being declared out.

### **3. Fire Cooperators:**

- \* Provide assistance in suppression of wildfires and conducting prescribed burns as defined in cooperative agreements and memorandums of understanding.

## **VIII. WILDFIRE PROGRAM**

### **A. Fire Prevention**

The majority of the wildfires occurring on the Complex since 1985 were human caused and thus could have been prevented. Human caused fires have the potential to be the most damaging because they can occur at times of the year when fewer initial attack resources are available and fuels are cured.

Agricultural field and roadside burning seasons occur in the spring and fall. These burns have accounted for 43% of the fires recorded within the nine county area of the Complex since 1992.

Objectives of the Complex fire prevention program are to reduce the threat of human caused fires through visitor and employee education, to support the North Dakota Forest Service's fire prevention program to the fullest extent, and to integrate the prevention message into interpretive programs conducted or sponsored by the Complex.

The public and visitors to the Complex are generally very aware of fire prevention. Still, it is evident that a problem persists. Much of the problem stems from the two phased system of fire mitigation that has been North Dakota law for many years. This system treats prescribed fire totally different between state and federal land management agencies and the private sector. Regulation for burning on state or federal lands are much more restrictive than those on private lands, and currently there is no system in place to educate private citizens about fire behavior and fire management in general.

The Fire Marshal's Office is currently taking a closer look at fire prevention in North Dakota, and is developing a basic four hour training course for the public on fire management and fire behavior. This course is still under development, and lawmakers are discussing elimination of the two phase fire mitigation system in place of a single system that would require all individuals burning in the state to follow the same set of rules.

Fire prevention activities the Complex will utilize include:

- signing
- area closures when necessary
- public contacts through press releases and verbal contacts
- enforcement of regulations and prosecution of violators
- employee training and awareness
- adherence to the step-up plan included in this document
- implementation of State regulations and restrictions
- contacts with area cooperators and neighbors
- attendance at local rural fire department meetings
- mowing of road shoulders and unpaved trails to reduce the incidence of vehicle ignited fires

- periodic presentations to local area schools

## **B. Fire Season**

According to the Fire Management Information System and the Service's FireBase budgetary system, the historic wildfire season for the Complex is 100 days. This is a split season and runs from April 21 through May 20, and from October 18 through December 16. The historic prescribed fire season runs from April 1 through October 27. The prescribed fire season length has been determined to be 210 days. The combined fire season for the Complex is April 1 through December 16, a total of 260 days.

## **C. Fire Behavior Potential**

See previous sections and BEHAVE runs in Appendix M.

## **D. Fire Preparedness**

### **1. Personnel**

Provided sufficient funding is available, the Complex will employ a minimum of six firefighters during the primary fire season to perform preparedness, emergency presuppression and wildfire suppression functions. All fire management staff will be assigned to report to the Complex headquarters area. A minimum of two seasonal/temporary firefighters will be housed in seasonal housing located at the Complex headquarters for initial attack purposes after normal business hours. The Complex FMO will coordinate support of preparedness, emergency presuppression and suppression activities with the Refuge Manager, Supervisory ROS, and ROS during the fire season.

Only red card qualified employees will be dispatched to fires. Non red-carded employees may assist in support capacities, but will not be permitted on the fireline. A minimum of 6 red carded employees should be available on the Complex during the established wildfire season.

Additional firefighters (emergency hire (AD)/casual firefighters) may be temporarily hired to supplement fire crews using severity or emergency presuppression funding when very high or extreme fire danger conditions warrant. Fire readiness guidelines are listed in Appendix R. This guide will be utilized on a monthly basis to insure program readiness throughout the year.

### **Physical Fitness**

All personnel involved in fire management activities will meet the fitness standards established by the Service and Region. At this point in time, firefighters participating in wildfire suppression must achieve and maintain an **Arduous** rating. Firefighters participating in Prescribed Burns must achieve and maintain a **Moderate** rating. Information found in Appendix Z provides specific instructions to

administer the tests, a health screening questionnaire to aid in assessing personal health and fitness of employees prior to taking the test, an informed consent form, and safety considerations. A trained and qualified American Red Cross First Responder (or equivalent) who can recognize symptoms of physical distress and appropriate first aid procedures must be on site during the test.

Wildland fire fitness tests shall not be administered to anyone who has obvious physical conditions or known heart problems that would place them at risk. All individuals are required to complete a pre-test physical activity readiness questionnaire prior to taking a physical fitness test. They must read and sign the PAR-Q health screening questionnaire, an informed consent form (**Appendix Z**). If an employee cannot answer NO to all the questions in the PAR-Q health screening questionnaire, or is over 40 years of age, unaccustomed to vigorous exercise, and testing to achieve a Moderate or Light rating, the test administrator will recommend a physical examination. As noted below, all individuals over 40 years of age **must** receive an annual physical **prior** to physical testing.

### **Physical Examinations**

All individuals involved in arduous fire management activities over the age 40 or newly hired fire management personnel are required to complete an annual physical fitness examination. Standard forms and procedures required by the Service will be used and followed. The cost of examination will be born by the Service and the results sent to the Region Personnel Department.

## **2. Training**

Service and NWCG policy establishes training, qualification, and fitness standards for all fire positions. All fire personnel (full time fire or collateral duty) will be provided with the training required to meet fire job qualification standards for the jobs they will be expected to perform. Personnel will not perform fire jobs for which they are not qualified.

### **Annual Refresher Training**

All personnel involved in Fire Management activities are required to participate in 8 hours of fire management refresher training annually in order to be qualified for fire management activities in that calendar year. Refresher training will concentrate on local conditions and factors, the Standard Fire Orders, LCES, 18 Situations, and Common Dominators. NWCG courses Standards for Survival, Lessons Learned, Look Up, Look Down, Look Around, and others meet the firefighter safety requirement; but, efforts will be made to vary the training and use all or portions of

other NWCG courses to cover the required topics. Fire **shelter use and deployment**, under adverse conditions, if possible, **must** be included as part of the annual refresher.

The Complex FMO will coordinate training for all station staff. Some training courses such as Standards for Survival, ATV Safety and Basic Aviation Safety may be conducted on site if warranted. Other training will be acquired through the interagency training calendars. The Complex FMO will monitor course schedules, keeping updated on courses offered through the various interagency training lists.

Additional local training courses are hosted by various state and federal agencies in the ND/SD zone and are available to station staff. In addition, the Service provides numerous courses throughout the year in Region 6. All station employees who are base funded out of fire accounts will have a fire management training needs assessment completed for them outlining training and experience deficiencies and future position goals. It is recommended that a similar process be completed for all non-fire funded staff as well.

### **3. Equipment**

The Complex has a Forest Technology Systems model FTS-11 remote automated weather station located at Arrowwood NWR. This weather station automatically calculates a wide range of fire weather data including temperature, relative humidity, wind speed and direction, precipitation and fuel moistures. The corresponding Fire Weather Plus IBM computer based software also calculates National Fire Danger Rating System (NFDRS) indices along with Keetch-Byram Drought Indices (KDBI) and several other fire weather and fire behavior factors.

Engines are the primary initial attack resource used on the Complex due to the predominance of fine fuels and easily accessible terrain. Earth moving equipment is available but not recommended for use due to resource damage concerns.

**Table 14** profiles the equipment needs of the Complex identifying both the current level of stocking and documented additional needs.

**Table 14 Arrowwood NWR Complex Normal Unit Strength - Equipment**

Item	Year Purchased	% of Fire Funding	Have	GVW	Need	GVW
Engine Module(s) Heavy(500-1000 gal) medium(200-400 gal) light (50-150 gal)	1997,1999, 1998,2000- ATV	100,100 100,100	2 2	12,000, 17,500	1 2 2	26,000 17,500
Slip-on unit(s)	1990, 1991	100,100	3		0	
Water Tender(s)	Excess Property		1	26,000	0	
Portable Pump(s) Standard float-a-pump	1998-2000 1993-1995	100 100	5 2		2 0	
Power Saws	Various	100	4		2	
Mower(s) Bush Hog ATV Mowers	Various 1994,1999, 1995	0 100,100,0	2 3		0 0	
Tractor(s) JD	1993 1995 1999	0 0 0	0 0 0		0	
Grader(s)	1999,1998	0	2		0	
Plow Unit/Disk	Unknown	0	3		0	
ATV(s) 4 wheel 6 wheel	1993 1998,2000	100 100	1 2		1 2	
Radios Low Ban Portable High Band Portable Low Band Mobile High Band Mobile	Various Various Various Various	100 100 50 100	7 6 12 6		6 2 4 3	

All engines are outfitted with the required minimum gear to support local fire operations. The Complex has two Type 6 engine modules (Model 52) outfitted with a full accompaniment of equipment as outlined in the NWCG Fireline Handbook(PMS 410-1) and the Northern Rockies Coordination Group interagency standards for Type 6 engines in this geographic area. These engines are intended to be used when interagency requests are received, and are the only engines that will be detailed out of North Dakota.

The Complex has numerous other vehicles that can be used in support of fire operations if needed (pick-up trucks, farm tractors, farm implements), along with adequate supplies of firefighter personal protective equipment and miscellaneous

fire management supplies.

Additional program needs include both heated and unheated storage space for fire equipment. Currently some equipment is stored outside year-round. A six bay garage or pole shed with half of the bays heated would greatly increase operational efficiency and safety. Due to starting and ending fire season dates well within periods with local daily low temperatures below 32 degrees, our pumpers must sit without water to prevent damage from freezing, lengthening our response time to wildfires considerably. Because of inadequate storage space our fire equipment is stored in several locations, making organization difficult and again increasing response time.

The Complex has instigated weekly preventative maintenance and readiness checks of all fire vehicles. This process begins several weeks prior to fire season and continues for several weeks after the close of the season in the fall. All fire equipment has established maintenance and readiness check files that are used to document when checks were completed and note any ongoing deficiencies or scheduled maintenance needs. Complete vehicle readiness checks are always completed prior to any prescribed burn or interagency detail as well.

## E. Emergency Preparedness & Pre-Suppression

Staffing Class breakpoints were determined using a FIRE FAMILY analysis of 10 year fire weather data from a fire weather station at Theodore Roosevelt National Park in Medora, ND (200 miles southwest of Complex headquarters). This was the closest station to the Complex that had the required 10 years worth of data needed to establish accurate 90<sup>th</sup> percentile burning indexes and staffing class breakdowns. Table 15 illustrates these staffing classes and associated burn index (BI) ranges.

Federal fire management funding is based on providing the required staff and equipment to successfully initial attack and control wildfires up to the 90<sup>th</sup> percentile Burn Index, or roughly 90 percent of the time. Conditions over the 90<sup>th</sup> percentile mark usually require additional resources from off station to manage. Staffing classes are often determined using burn index values, and are commonly utilized in the development of emergency preparedness Step-Up Plans. A Step-Up Plan outlines actions to be taken to insure full preparedness of fire suppression equipment and personnel during a range of potential fire occurrence and fire behavior conditions. Step-Up Plans are discussed in greater depth later in this section, and a complete copy of the Complex Step-Up Plan can be found in Appendix R.

**TABLE 15**  
**FIRE DANGER STAFFING CLASS AND ASSOCIATED BURN INDEX RANGE**  
**NFDRS Fuel Model N - Tall Grass**

STAFFING CLASS:	BURN INDEX RANGE
SC - I	0 - 21
SC - II	22 - 43
SC - III	44 - 88
SC - IV	89 - 109
SC - V	110+

In 1993 the Complex erected a Forest Technology Systems model FWS-11 remote automated weather station at the Arrowwood NWR office location in Stutsman County. This station monitors and records pertinent weather data including fuel moisture, relative humidity, temperature, and wind speed and direction. The station is linked to a fire management computer via phone, and includes computer software models to calculate National Fire Danger Rating System(NFDRS) indices. An additional software module was purchased that computes the Keetch-Byram Drought Index (KBDI) based upon local weather data. The system was installed in October of 2000, and will be used to track NFDRS indices over time to update staffing class burning index and other fire danger factors. In the future when sufficient history becomes available for an accurate statistical analysis, the staffing class and Step-Up Plans will be re-written to incorporate more valid local data.



The FWS-11 weather station information will also be periodically downloaded into the Weather Information Management System (WIMS) for cataloging and use in establishing NFDRS trend analysis data and periodic re-calculation of 90th percentile burning index (BI) and other factors used in fire danger ratings. Ideally, 10 years of data are needed for accurate 90th percentile BI determination.

The NFDRS and WIMS systems are quite accurate for shrub, timber and slash fuel models, and can also be a large asset to fire programs in primarily grass fuel models when moderate to high complexities and fire occurrence are present. The Complex generally has low to moderate fire complexities and low numbers of ignitions, thus a step-up plan based solely on burning index would for the most part be significant overkill.

The State of North Dakota issues a Rangeland Fire Index that is calculated daily during fire season by the National Weather Service (NWS) in Bismarck, North Dakota. This system relies mostly on calculation of greenness factors of fuels and comparison to normal historic values for the identical day of the year. Greenness factors are calculated by an Advanced Very High Resolution Radiometer (AVHRR) onboard NOAA weather satellites. Satellite calculated greenness factors are combined with forecasted wind speeds and relative humidities to establish a daily fire danger rating by county for the State.

Although this process can provide useful information for fire managers, it does not adequately show trends in wildland fuel changes due to the significant amount of state land in cropland, pasture and hay lands. The profound difficulty the NWS has in producing accurate weather forecasts throughout much of the State adds to the problem. The Bismarck NWS Office does not have a fire weather forecaster on staff, further elevating accuracy problems.

Typically, rangeland fire danger ratings can go from extreme to low in a one day period entirely due to a single factor such as wind speed or relative humidity, without any measurable precipitation or change in fuel conditions. An additional complication arises from the fact that standard agricultural crops and lands being grazed or hayed do not come close to mimicking conditions in wildland vegetative communities.

In 1997 the North Dakota Fire Council met with North Dakota Forest Service and Bismarck NWS Office personnel to initiate changes in the calculation of daily rangeland fire danger index. Some valuable changes were incorporated into the system to utilize wildland areas more extensively in the rangeland fire danger index calculation process, but more work needs to be done to truly make this an accurate and reliable index for basing emergency pre-suppression and preparedness programs for Service fire management staffs.

In order to develop a truly accurate emergency pre-suppression and preparedness program on the Complex, a step up plan has been compiled that considers NFDRS ratings, specifically BI, daily Rangeland Fire Danger Index, and the Keetch-Byram Drought Index to produce what we consider the most realistic step-up and emergency pre-suppression policy possible at this time. The Complex Step-Up Plan can be found in Appendix R.

Fire managers will continue to experiment with a variety of methods in order to facilitate the further development of a more accurate fire danger rating and emergency preparedness program on the Complex due to the unavailability of a current system for North Dakota that has proven accuracy. Systems monitored may include the Palmer Drought Index, Keetch/Byram Drought Index, State of North Dakota rangeland fire danger index, and NFDRS indices including Burning Index, Energy Release Component and Ignition Component, along with other available systems. These factors will be computed either by on site RAWS stations, acquired from the NWS, the Billings Dispatch Center, or through Internet data acquisition.

When conditions are warranted based upon approved Step-Up Plan guidelines, a request to establish an emergency pre-suppression account will be made to Regional Fire Management Coordinator (RFMC). Once this account (PE-06) is established the Supervisory ROS, Refuge Manager or Fire Management Officer may authorize overtime for Very High or Extreme step up actions that cannot be met with regularly scheduled employees. Collateral duty firefighters may be assigned emergency pre-suppression duties if needed. Backfill behind employees may be authorized.

#### **F. Severity and Emergency Presuppression Funding**

Severity funding is different from Emergency Presuppression funding. Emergency Presuppression funds are used to fund activities during short-term weather events and increased human activity that increase the fire danger beyond what is normal. Severity funding is requested to prepare for **abnormally extreme fire potential** caused by unusual climate or weather events such as extended drought or strong windstorms. Severity funds and emergency presuppression funds may be used to rent or preposition additional initial attack equipment, augment existing fire suppression personnel, and meet other requirement of the Step-up Plan.

To provide adequate fire protection for the Complex during years with abnormally extreme fire potential or long term drought, a request for severity funding is made in writing to the RFMC stating specific needs for personnel, equipment and funds. The request is reviewed by the RFMC, then passed on to the Director of the Service through a formal request from the Regional Director.

Emergency Presuppression and Severity funds will be requested in accordance with the guidance provided in the Service's Fire Management Planning Handbook. As a general guide, Severity funding will be requested if a severe drought is indicated by a Palmer Drought Index reading of -4.0 or less or a Keech-Byram Drought Index of 625 or greater **and** a long-range forecasts calling for below average precipitation and/or above average temperatures. Drought Indices can be located at:  
<http://www.boi.noaa.gov/fwweb/fwoutlook.htm>

## G. Detection

The Complex relies on employees, neighbors, visitors, and cooperators to detect and report fires. In addition, the Step-up plan provides for increased patrols by refuge personnel during periods of very high to extreme fire danger.

## H. Fire Suppression

Economic impact of past wildfires in the area have consisted of temporary loss of livestock forage, destruction of crops, stored hay and improvements, and temporary loss of recreational value. Fortunately, these past fires have generally not jeopardized life or personal property. The potential for these kinds of damaging or disastrous fires always exist.

Wildfires have been a natural component of the Complex and surrounding ecosystems for thousands of years and any temporary loss of wildlife or wildlife habitats may be offset by fire's beneficial effects. Fire suppression activities over the years have to some extent ignored the fact that fire is a natural component of the environment. Consequently these activities have had negative effects. Generally, native species of vegetation that derive some benefit during their life cycle from fire have suffered while those species that are not fire tolerant (woody species and exotic invaders) have benefitted.

Another effect of past fire suppression activities has been the accumulation of fuels, including timber, shrub and grass habitat types. These accumulated fuels, when burned, tend to produce very hot fires which can damage vegetative species that normally would not be affected. They also make the possibility of larger, potentially disastrous fires much more likely.

Previous impact of past fire suppression activities include heavy equipment use to create fire breaks. In many of these areas the fire breaks are clearly visible while all evidence of the fire has long since disappeared. Fire breaks created with heavy equipment also tend to allow increased expansion of unwanted exotic invader species such as leafy spurge and Canadian thistle to establish, hampering control efforts. The use of heavy equipment to construct fire breaks is restricted in the Complex. These types of fuel breaks must be approved by the Supervisory ROS or Refuge Manager, and will only be used when serious threat to life and property exists. The Complex will utilize **minimal impact suppression strategies** when possible. Retardants will not be used within 300 feet of all wetlands.

All management decisions on the Complex should comply with the legislative authorities creating the Complex and established goals and objectives listed in Section II, parts A and B. Fire is part of the natural setting and **appropriate management response** should take this into account by utilizing indirect attack methods and monitoring/surveillance to the extent possible.

## **1. General**

The Arrowwood National Wildlife Refuge Complex is a full suppression area with suppression strategies and tactics based upon appropriate management response. Service policy requires the refuge to utilize the ICS system and firefighters must meet NWCG and Service qualification requirements for fires occurring on Service property.

All suppression efforts will be directed towards safeguarding life and property while protecting the Complex's resources from harm. If additional firefighters or other resources are needed, other than local resources(VFD's), appropriate interagency resource ordering procedures will be followed to acquire resources through the interagency dispatch center located at the J Clark Salyer NWR.

## **2. Initial Reporting and Dispatch**

All fires occurring within or adjacent to the Complex will be reported to the Complex headquarters. The person receiving the report will be responsible for delivering the report to Complex staff for implementation if the fire occurs during normal Complex hours of operation. If the report occurs after normal Complex hours of operation, the individual receiving the report will be responsible for implementing the Complex Fire Dispatch Plan. Copies of this plan are available in the Arrowwood office and a folder containing the plan and dispatch logs is kept next to the main Complex radio terminal at the headquarters front desk. Appendix S contains a copy of the 2001 Complex Fire Dispatch Plan.

Requests for assistance from cooperators on fires not threatening the refuge must be made to and approved by the Supervisory ROS, Refuge Manager, FMO or designee. Only qualified and properly equipped resources will be dispatched to off station wildfire assignments.

The Fire Dispatcher will be responsible for coordinating the filling and delivery of any resource orders made by the Incident Commander (IC) including personnel, engines, aircraft, tools, supplies, meals, and other support items. IC's will place all resource orders through the dispatcher, and will specify what, when and where it is needed. The Dispatcher will promptly determine if the resource orders can be filled or procured locally and notify the IC. If a resource order cannot be filled locally the Dispatcher will place the order through NDC, BDC or NRCC channels per current mobilization guide policy. Current copies of the NDC Interagency Mobilization Guide containing all required information pertaining to resource mobilization in North Dakota are available in the Arrowwood NWR office.

### **3. Initial Attack**

The FMO will serve as IC, or will appoint a qualified Incident Commander for each fire. The IC will be responsible for all aspects of the management of the fire. If a qualified IC is not available, one will be ordered through dispatch. All resources will report to the IC (in person or radio) prior to deploying on the fire. The IC will provide a size-up of the fire to the dispatcher as soon as possible, and determine the resource needs for the fire. Size-up information requirements can be found in the Dispatch Plan and also in the Fireline Handbook (PMS-410-1). The IC will be responsible for placing or canceling resource orders for the fire.

The IC will receive general suppression strategies from the FMO and refuge management per the Refuge Fire Management Plan, but tactics necessary to suppress the fire will vary according to each on-the-ground situation encountered. It will be up to the IC to implement the appropriate management response to effectively suppress the fire. Minimum impact tactics will be used whenever possible. Dozers, plows, discs, or graders will not be used inside the Complex boundaries for fire suppression without permission from the Project Leader, Refuge Manager or designee.

#### **Initial Attack Agreements:**

The Complex at the moment does not have any agreements with local RFD's. In the past the Complex had reimbursable agreements but according to the regional office these are no longer valid. No RFD has expressed an interest in non-reimbursable agreements. The essential RFD's will be contacted again in FY2001.

### **4. Escaped Fires/Extended Attack**

The IC or Supervisory ROS/Refuge Manager will notify the FMO whenever it appears a fire will escape initial attack efforts, escape Service lands, or when fire complexity will exceed the existing capabilities of the staff. The FMO will be responsible for coordinating extended attack actions including:

- \* Completion of a **Wildland Fire Situation Analysis** (WFSA) for the Supervisory ROS/Refuge Manager.
- \* Assignment or ordering of appropriate resources including coordination with NDC.
- \* Drafting the **Delegation of Authority** if needed.

**Appendix V** contains the Complex **Pre-Attack Plan** including copies of the Delegation of Authority document to be used by the Project Leader or designee to delegate authority to the IC for control of the incident, and a copy of the WFSA to be used in the event of an escaped fire situation.

## **I. Mop up Standards and Emergency Stabilization and Rehabilitation**

The IC will be responsible for mop-up and mitigation of suppression actions taken on Refuge fires. The mop-up standards established in the Fireline Handbook will be followed. Refuge fires will be patrolled or monitored until declared out.

Prior to releasing all firefighters from a wildland fire the following actions will be taken:

- \$ All trash will be removed.
- \$ Firelines will be refilled and waterbars added if needed.
- \$ Hazardous trees and snags cut and the stumps cut flush.
- \$ Disked firelines should be compacted as soon as possible to preserve the living root stock of natives grasses.
- \$ Overturned sod resulting from plowing must be rolled back with a grader or by hand and compacted to preserve native grass root stock.

Other emergency stabilization and emergency rehabilitation measures may be taken in accordance with Chapter 5 of the Fire Management Handbook. Briefly:

- ! **Emergency stabilization** is the use of appropriate emergency stabilization techniques in order to protect public safety and stabilize and prevent further degradation of cultural and natural resources in the perimeter of the burned area and downstream impact areas from erosion and invasion of undesirable species. The Incident Commander may initiate Emergency Stabilization actions before the fire is demobilized, as delegated by the Agency Administrator, but completing emergency stabilization activities may be completed after the fire is declared out.
- ! **Rehabilitation** is the use of appropriate rehabilitation techniques to improve natural resources as stipulated in approved refuge management plans and the repair or replacement of minor facilities damaged by the fire. Total "rehabilitation" of a burned area is not within the scope of the Emergency Rehabilitation funding. Emergency Rehabilitation funding can be use to begin the rehabilitation process if other funding is committed to continue the rehabilitation throughout the life of the project (beyond the initial 3 years of Emergency Rehabilitation funding). Major facilities are repaired or replaced through supplemental appropriations of other funding.
- ! Because of the emergency nature of the fire event, the emergency stabilization section of the Emergency Stabilization and Rehabilitation Plan (ESR Plan) must be developed expeditiously and is frequently developed by a local unit or designated burned area ESR team. The rehabilitation section of the ESR Plan is not considered an emergency, and is developed as other refuge land use plans. The refuge manager is responsible for preparing all ESR Plans. In order to be funded, ESR Plans must meet resource management objectives and be approved by the Project Leader and the Regional Director.

## **J. Records and Reports**

The IC will complete all situation reports as soon as practical. The IC will complete DI-1202 fire reports within 10 days and will ensure that all expenses and/or items lost on the fire are reported, that the timekeeper is advised of all fire time and premium pay to be charged to the fire, and that expended supplies are replaced. The FPT will assist with report compilation and entering the reports into the FMIS Fire Occurrence System.

## **IX. PRESCRIBED FIRE MANAGEMENT**

The Complex has been using prescribed fire as a management tool since the early 1970's. From 1985 to 2000, a total of 224 prescribed burns were accomplished treating 29,386 acres. Much of this has been accomplished since the Complex received fire staffing in 1992. These totals represent only 34% of the Complex's 87,000 acres within habitat types with historical fire frequency of 3-20 years. Average burn size was 131 acres during this period.

In the late 1980's and early 1990's, refuge management realized the need to increase prescribed burning as a habitat management tool. Prior to the mid-1990's, resource shortages hampered the Complex's ability to meet this need. In the past three years the Complex has gone from no fire staff to a permanent staff of three and a seasonal staff of four. Initial years have been taken up with expansion of the program on all fronts, with significant increases seen in planning, preparation, training and burn implementation. We anticipate a continued increase in the use prescribed fire within the Complex in the future, with a goal of burning a minimum of 5,000 acres on the Complex yearly.

New prescribed fire funding authority (9263 account code) will also help to increase the level of prescribed fire on the Complex. This funding is anticipated to continue in the coming years. The new FireBase budget allocation program recognizes prescribed fire as an integral part of Service fire management programs, something the former FIREPRO system did not. With FireBase, refuges will have the ability to form prescribed fire districts to supply fire management resources for prescribed fire implementation on stations that in the past had never received any assistance.

Currently the Complex has created a prescribed fire district that includes the Arrowwood NWR/WMD, Chase Lake NWR/WMD, Valley City WMD, and the Long Lake NWR/WMD. Prescribed fire resources are stationed at all four stations with the understanding that these resources are to be used to assist all other stations. Since 1992 this system has been developing, with Complex resources assisting with all burns conducted within the complex and roughly 60% of burns conducted on Long Lake NWR Complex during this period.

Prescribed fire resources, as well as wildland fire resources are looked upon as regional and national resources, thus Complex fire staff and equipment often assist other fire programs as needed. When the need arrives and the Complex is able to fill requests for assistance, the Complex will send resources to other Service units in this and other Regions to provide aid for

other prescribed fire programs. Complex management realizes this is the structure of the Service fire management program, and is aware that the current prescribed fire district is in place and the Complex will commit to providing assistance when requested if possible. We expect an expansion of this process in the coming years as prescribed burn programs increase on all District units.

The Complex breaks prescribed fire into two distinct management purposes: 1)Resource management or habitat improvement burning, and 2)Burning for hazard fuels reduction.

#### **A. Resource Management Prescribed Fire**

The goal of resource management prescribed fire is to restore, create, and maintain a healthy diversity of plant communities in order to restore and perpetuate native species of flora and fauna. The use of prescribed fire for resource management on the Complex has gone through the NEPA process and is specifically addressed in the Environmental Assessment completed for managing upland habitats on the Complex approved in 1994. Meeting Complex prescribed fire program goals would include the following activities:

1. Restoration and propagation of native prairie grass and forb species.
2. Reduction and control of non native grasses, especially Kentucky bluegrass, quackgrass and smooth brome.
3. Control of woody species invasion of grasslands and wetlands including aspen, mixed hardwoods, Russian olive, willow, snowberry and other assorted shrub types.
4. Assistance in controlling noxious weeds, particularly leafy spurge and Canada thistle.
5. Control of dense cattail and bullrush growth in shallow wetlands.
6. Maintenance and rejuvenate of quality nesting cover for waterfowl.
7. Assisting in preparation of seedbeds for native grass and DNC plantings.
8. Assistance in preparing areas of the refuge currently in cropland for annual re-seeding.
9. Removal of unwanted slash piles from mechanical removal of shelter belts and other tree plantings on recently acquired lands.
10. Removal of decadent hay, straw and flax bales on Complex lands previously under haying permits.

Achieving many of the Complex goals will require repeated prescribed burns over a 10-20 year period with a 3-5 year burn frequency. Under current levels of staffing, this may not be feasible.

#### **Resource Management Prescribed Fire Objectives:**

1. Treat 5,000 or more acres including 15 to 30 prescribed burn units per year on the Complex to accomplish resource management goals (assuming current level of funding).



2. Assist with burning of 1,000 to 1,500 or more acres per year at Long Lake NWR/WMD).

Increases in the above totals are possible only with an increase in funding and fire staffing. At the current level of funding the prescribed fire program cannot meet this need. Additions to the Complex's permanent fire staffing, specifically a Prescribed Fire Specialist, additional career-seasonal fire staff and an Engineering Equipment Operator, new equipment purchases including reliable mowers and additional ATV's, and additional seasonal fire staff during the spring and fall months would provide the resources to increase the prescribed burn program to the level needed to reach Complex goals and objectives. These needs are outlined in Tables 13, 14 and 15.

## **B. Hazard Fuels Reduction Prescribed Fire**

The goal of the Complex hazard fuel reduction program is to use prescribed fire within or near Complex development zones, historic high fire occurrence zones, areas with particularly difficult suppression characteristics, wildfire sensitive resources, and specific WPA and Refuge boundary areas to reduce the risk from wildfire damage and increase the safety and efficiency of wildfire control efforts.

WPA and Refuge boundary zone burn units are selected based on values at risk on adjacent lands, probability for escape from Service land, and fuels. Fuels in hazard fuel sites have 6-10 inches or more of accumulated grass litter (fuel models 1 and 3), high densities of shrubs (fuel models 5 and 6), or extreme fuel loadings of 100 and 1000 hour fuels due to wind damage, over maturity or prior wildfire damage (fuel models 9 and 10). These factors can cause control problems during suppression actions. High litter loadings allow wildfires to carry even during full green-up conditions. To the greatest extent possible, hazard fuel burns will only be used when they can compliment resource management objectives.

### **1. Hazard Fuels Prescribed Fire Objectives:**

- \* Reduce dead grass fuel loadings by 75% or better
- \* Reduce woody shrub component by 50% or more
- \* Reduce quantities of 100 and 1000 hour fuels by 50% or more

### **2. Hazard Fuel Prescribed Fire Strategies:**

- \* Treat 1,000 to 2,000 acres per year
- \* Burn units once every 3-8 years depending on fuel accumulations and resource management considerations

## **C. Planning**

The Supervisory ROS, Refuge Manager and Complex Biologist are responsible for developing resource management objectives for individual units and determining unit priorities. The station FMO, Zone FMO and Regional fire staff will provide technical assistance in the use of prescribed fire as a management tool. Individual site specific burn plans will document objectives and the plan of action for achieving them. Burn plans can be written by any staff member, but must go through a review process specified by the RFMC.

Potential burn units will be selected yearly through meetings between the Supervisory ROS, Refuge Manager, FMO and Biologist. A review of the previous year's prescribed fire accomplishments, areas for improvement, and monitoring results will also take place at this time. Burn plan review and approval requirements vary according to complexity level.

All prescribed burn plans will address contingency planning. General contingency planning elements are listed in the following paragraph. These may be modified or more specific information regarding contingency planning may be included for a particular prescribed burn if the need exists.

The contingency section included in all prescribed burn plans will address the following essential elements:

- ! Trigger points that are clearly defined.
- ! Instructions for reporting an escaped fire or slop-over.
- ! Who has the authority to activate the contingency plan.
- ! The initial actions to be taken to suppress the wildland fire once it has been declared (Included in this section will be the organizational structure, strategy, tactics, additional resources, health and safety concerns).
- ! Who is to be notified when the contingency actions are implemented.
- ! The location of values or resources requiring protection and established priority for providing protection.
- ! Containment opportunities outside of the burn unit (i.e. fuel breaks, roads, and other areas), water sources, etc.

Determining when to implement the contingency plan or declare a prescribed fire a wildfire will vary with every situation. Therefore, clearly defined trigger points that indicate when the contingency plan will be implemented and under what circumstances the prescribed fire will be declared a wildfire will be identified in each prescribed burn plan. The following are examples of trigger points that may be included:

- ! When three or more slop-overs occur within a 30-minute period or when an escape exceeds the ability of the holding forces on scene to suppress it within 15 minutes.
- ! When private property, cultural resources, structures and critical habitat are threatened.
- ! When the fire behavior predictions exceed the prescription parameters (MANDATORY).

Complex fire and maintenance staff will be responsible for preparing all fire equipment used for prescribed burning prior to May 1, and will also insure that weekly checks and daily checks prior to burns are completed.

Prescribed burn units may require pre-burn preparation including mowlines, disc lines, blacklining, chainsaw preparation or other preparation methods as stated in the individual burn plan. Some units may also require advanced public relations work prior to burn initiation. All burn unit preparation as outlined in the individual burn plan will be completed prior to implementation.

The normal prescribed fire season begins approximately April 1

depending upon weather factors, and continues until late fall. Some units may not be burned between June 15 and July 15 in order to avoid burning waterfowl nests and to correspond with haying limitations placed on local ranchers with refuge hay permits. Burn timing depends on unit objectives, staffing, weather and other factors. Burning may occur during the winter months depending upon snow conditions and objectives. Winter burns are generally for cattail control in wetlands and for burning blacklines to be used as control lines for future burn units.

Each prescribed burn unit requires an open burning permit from the State of North Dakota Department of Environmental Health. Procedures for obtaining permits can be found in Appendix K.

The Complex lies within the Northern Rockies Interagency Fire Coordination Center geographical area (NRCC). Prescribed fires cannot be ignited when the NRCC is in a fire preparedness level of V (extreme) or when the National Preparedness level is V without concurrence of the Northern Rockies Coordination Group. When the North Dakota Rangeland Fire Danger Index is in the Extreme category, verbal permission must be obtained from the State Forest Service, Fire Marshal's Office or local rural fire protection district chief.

Under ideal conditions and with sufficient staff, multiple units may be burned at the same time within the Complex. The maximum number of simultaneous burns may be regulated by the cumulative impacts of smoke on sensitive targets. The Complex FMO or other qualified Prescribed Fire Manager will be available to coordinate the management of simultaneous burns. Sufficient suppression forces must be available for each burn in the event of an escape.

With the increase in education and the realization by many cooperators that fire is a necessary part of the North Dakota native grasslands, it is likely that in the near future Complex fire staff may assist other local state and federal agencies or private landowners in conducting prescribed burning operations on private lands. The issue of burning on private lands is currently being addressed at the Regional level. Appendix X contains the draft Region 6 policy for private lands burning. Once the final policy is approved and distributed to the field, this draft will be replaced with the final copy. Service prescribed fire funds can not be used for burning on private lands.

The North Dakota Fire Council (NDFC) is in the process of completing a statewide fire agreement that will cover all local, State and Federal fire management agencies in North Dakota. This agreement will address prescribed fire and establish methods for agencies to assist each other including cost reimbursement procedures. Once this agreement is in place, cross-agency prescribed fire assistance will be much easier.

Until a statewide agreement is completed, a specific cooperative agreement or memorandum of understanding must be completed to allow Complex resources to assist with prescribed fire projects on non-Federal lands.

## **D. Training**

The Complex will meet policy requirements of the Service prescribed fire qualification system. The Project Leader will be responsible for ensuring Complex personnel maintain qualifications necessary to implement the fire program. Minimum staffing requirement to support the Complex's prescribed fire program are listed in Table 13. Training will be obtained for Complex personnel in the area of fire effects and monitoring in prairie ecosystems as the need arises in order to implement emerging Service ecosystem management strategies. Funds are available to train non-service personnel(VFD's) so they can assist with fire management activities.

## **E. Complexity**

The FireBase Complexity Analysis Guide and corresponding worksheets have been incorporated into the Region 6 prescribed burn plan format. Each individual burn unit will have a complexity analysis completed for it and attached as an element of the prescribed fire plan prior to the review and approval process. Plans submitted without this element will be returned unapproved by the Zone FMO.

There are three recognized complexity levels based upon the prescribed burn complexity guide and worksheet. Low complexity burns are those burns with a total complexity score of between zero and 115. Moderate or "normal" complexity burns are scores that range from 116 to 280, and high complexity burns range in score from 281 to 450.

Low and normal complexity burn plans must be reviewed by the Zone FMO, burn boss and Refuge Manager/District Manager or Project Leader, with final approval granted by the Refuge Manager, ROS or Supervisory ROS. High complexity burns must be reviewed by the Zone FMO, burn boss, Refuge Manager, ROS or Supervisory ROS, and RFMC or Regional Prescribed Fire Specialist, with final approval granted by the Project Leader.

Most burns on the Complex fall within the low and normal complexity categories as determined by the FireBase Complexity Analysis, requiring an RXB2 or RXB3 to manage. We anticipate very few burns being conducted on the Complex that would fall within the "High" complexity category requiring an RXB1. The average number of personnel required to conduct a burn on the Complex is 6-8, but some units may require 15 or more as specified in the individual burn plan.

## **F. Monitoring and Evaluation**

Current monitoring and evaluation of prescribed burns is often limited due to funding and staffing limitations. Burn prescriptions and timing are normally based on past research (Higgins, Smith, Kruse, Kirsch, and others), thus detailed individual unit monitoring, especially on grassland units, is often not necessary.

Complex staff have spent considerable time and effort to establish clear goals and objectives for managing habitats within the Complex. Prescribed fire is identified as an integral tool needed to meet these objectives. Although we already have a fundamental understanding of fire ecology in the northern grasslands, site specific monitoring and evaluation of prescribed burns is essential in understanding fire as a tool to manipulate vegetation and landscapes. Refuge managers must be able to determine if 1) the prescribed fire program, and 2) individual fire treatments are meeting stated objectives. Information garnered from monitoring programs will be used to modify stated objectives, or the strategies used to meet those objectives. A sound monitoring approach will also allow managers to justify these objectives and strategies to potential critics both within and outside the Service.

Vegetation transects were established on some burn units from 1997 through 2000. Grassland physical structure, plant communities, and fuel loads are the main variables measured within these transects. Transects are monitored in the year prior to a planned burn, and again in the year after the burn for first order fire effects information. Many of the established first order fire effects transects have been incorporated into long term monitoring studies as well.

Fire monitoring protocols for the Region have been established, as have monitoring protocols to be used within the Complex. Fire managers have the ability to use the protocol they feel is most applicable for their unit. Some stations of the Complex have adopted the protocol developed by Grant, Madden and Murphy at J Clark Salyer and Des Lacs Refuges in North Dakota. Plant species composition, % cover, and changes in stand structure will be monitored to determine burn response and long-term (multiple treatment) vegetation responses. Copies of the Region 6 monitoring guide and the Grant/Madden/Murphy monitoring technique are located in Appendix Y.

Pre-burn evaluations within other grasslands is often limited to photo points, general photos or robels. The minimum being robels. Burn day evaluations document temperature, relative humidity, windspeed, fine fuel moisture, rate of spread, flame length, smoke dispersal, % litter reduction, and % scorch of woody species. Post burn evaluations within these units are limited to photo points or general burn photos, and qualitative estimates of shrubs, noxious weed abundance and cover, and native species response.

The process of defining the needs and providing direction for station monitoring and fire research programs is listed below along with a short discussion of actions taken.

#### **Prescribed Fire Monitoring and Evaluation Processes:**

1. Conduct extensive background research to access available knowledge pertaining to fire ecology and fire effects within the various fuel models, plant and animal species and habitat types found on the Complex. It is the opinion of Arrowwood NWR Complex staff that much of what a normal monitoring and evaluation program would show in this area has already been tested and documented within habitats of

the northern Great Plains. Therefore, ongoing monitoring and evaluation should concentrate on examining aspects of fire ecology and fire effects for which little or no available information exists. Because of the diversity of habitats within the Complex, the sampling of plant communities and animal/habitat associations are yielding models that will help predict the outcome of habitat manipulations, and also prioritize where treatments should occur.

2. Utilize all available sources of information to establish an accurate picture of natural historic fire regimes for the Complex. Establish Complex prescribed fire programs based upon this knowledge to the extent possible.
3. Explore historic documentation to understand the natural occurring flora and fauna of the area prior to European settlement. Contrast vegetation changes since presettlement times and document factors implicated in these changes.
4. Combine the available knowledge concerning fire effects and fire ecology, historic fire regime and historic plant and animal species composition to determine the additional monitoring and evaluation needs for the Complex.
5. Develop management plans to outline the implementation of monitoring programs within the Complex.
6. Develop proposals and request funding for the various (level of intensity) monitoring programs from available sources.
7. Conduct funded monitoring and research, basing future management decisions on program results. Utilize program results to question additional fire ecology issues and prioritize fire treatments and schedules, alone or in combination with other treatments (e.g., grazing, haying, mechanical, etc.).

Extensive work has been accomplished in the process of developing and implementing a monitoring and fire research program at the Complex. Ongoing and completed projects are described below.

#### **Literature Review.**

Refuge staff have conducted extensive searches of available databases to obtain as much available information relating to specific fire effects, fire ecology, historic fire regimes and pre-European habitat conditions.

Numerous fire databases have also been tapped including the Fire Effects Information System. Information requests have been made to university libraries and Federal and Canadian government sources as well.

#### **GIS Database.**

In 1999 work began on establishing baseline data for creating a GIS database for the Complex. GIS computer equipment and software was purchased in 1997 and 1999.

This GIS database will form the foundation of future fire monitoring, documentation, and planning on a landscape scale, and will greatly expedite the overall monitoring process.

## **G. Prescribed Fire Impacts**

Environmental impacts of the prescribed fire program are discussed in previous sections of this Fire Management Plan. An Environmental Assessment addressing prescribed fire is included in the plan and can be found in Appendix B.

Social and economic impacts are discussed in this section. The Complex covers a nine county area and does not contain any of the state's larger metropolitan areas. There are numerous small towns and communities within the Complex, but none with populations over 20,000. The main industry in the area is agriculture, and the majority of other industry is agriculture related.

The overall social and economic environment can be affected by how the habitats on the Complex are managed. Often the effect is local, but when all Complex land units are combined, the effect is more widespread. Habitat management is often accomplished by authorizing local farmers to hay or graze on WMD's and Refuge units. This is viewed as positive both socially and economically. Local farmers and ranchers prefer to hay or graze lands on the Complex rather than seeing them "go up in smoke".

The majority of neighbors accept the fact that the Federal government owns land for waterfowl production, and most have a general appreciation for the value of wildlife. However, these neighbors expect the land to be managed for wildlife and not ignored. If Complex lands are ignored, allowing the habitat condition to decline in quality and noxious weeds to increase, opinions quickly become negative. If the land is managed for the best interest of wildlife and habitat conditions are maintained, these opinions become positive and wildlife benefits both on and off Service managed lands. Prescribed fire is one of the tools necessary to manage Complex lands.

The majority of recreational uses on the Complex are centered around hunting and bird watching. Many of the Complex lands offer some of the best waterfowl hunting and birding in the nation. Hunters and birders come from all over the United States to visit the area. Annual visitation to the Complex is estimated at 50,000 per year. Occasionally hunters and birders may comment negatively when they see black, burned areas, but in general most of these people understand the need to utilize fire on the Complex after a short discussion with refuge staff. Negative impacts to the local economy could result if habitat becomes less productive and wildlife populations decrease. The number of hunters and birders traveling to the area could decrease, depriving the local economy of recreation dollars. As shown in this plan, increased use of prescribed fire will increase wildlife populations, thus providing an economic

benefit to the area.

Escaped prescribed fires pose a threat to adjacent life and property, but proper planning and prescriptions, qualified personnel, and contingency planning can mitigate this threat. Temporary air quality impacts from smoke may occur, but are generally mitigated by the fuel type (light flashy fuels), small burn unit size, and adherence to prescription parameters.

Negative public opinion for the prescribed fire program will be addressed through proactive public information and education efforts. Depicting the positive effects of prescribed burning should have a limiting effect on negative opinions. See **Section XIII** for specific actions.

## **H. Reporting and Documentation**

Individual prescribed burn plans, DI-1202 fire reports, and fire behavior and effects monitoring data sheets will be the primary documents used to record prescribed fire information. Burn plans document state air quality requirements, personnel, costs, fire behavior, weather, and burn critique information. DI-1202 forms will be completed and entered directly into the FMIS fire occurrence system within 15 days of the fire being declared out.

## **X. AIR QUALITY**

See previous **Section III. M.**

## **XI. FIRE RESEARCH AND MONITORING**

The Complex will continue to encourage fire related research projects on Service lands where research operations will not conflict with unit management objectives. Current fire research is discussed in previous sections of this plan, see **Section IX, part F.**

## **XII. PUBLIC SAFETY**

Firefighter and public safety will always take precedence over property and resource protection during any fire management activity. Firefighter safety is covered throughout this plan. This section will deal with public safety.

Fire fronts in grass fuels are fast moving and dangerous. Entrapment is a threat to sportsmen and visitors who may be in the area. Neighbors who initiate their own suppression actions lack proper training, equipment, and communications and may be at risk. The Complex staff will attempt to keep the fire scene (wildfire and prescribed fire) clear of people except for Service firefighters and cooperating volunteer fire departments. Burn areas are closed to the public during prescribed fires.

Smoke from prescribed fires is part of the burn prescription and is the responsibility of the burn boss. Actions to manage smoke include: use of road guards and pilot car, signing, altering ignition techniques and sequence, halting ignition, road



closures, requesting traffic control assistance from the county Sheriff or State Police, or suppressing the fire.

Wildfires which might escape from Service lands and spread to inhabited private property are also a concern. The IC is responsible for warning and evacuating the public from potentially dangerous wildfires. Additionally the Complex will continue, where practical, to use prescribed fire to manage hazard fuels in high risk areas.

### **XIII. PUBLIC INFORMATION AND EDUCATION**

Informing the public is an important part of all aspects of a wildland fire management program including preparedness, suppression, prevention, and prescribed fire, and is also part of the FWS mission. During wildfires the IC is responsible for providing fire information to the press and the public. The IC may delegate this task as needed, or the Complex may pursue training a fire information officer to perform these duties if deemed necessary in the future.

Informing the public is a vital element of the prescribed fire program. The following actions will be used to promote the prescribed fire program to the public:

- press releases
- attendance at local volunteer fire department meetings
- including the prescribed fire message in Complex interpretive publications and materials
- personal contact with bystanders during prescribed burns
- following prescribed burn plans and preventing escapes
- developing a quantitative fire effects monitoring program and sharing results with the public

Each prescribed burn plan approved for the Complex contains a section on public and media contacts. Prior to conducting any Complex burn, local RFD's, County Sheriff offices, and any local resident within a mile of the burn unit is contacted and informed of the burn project. Informational articles are submitted to local newspapers yearly prior to the start of the prescribed burn season. Articles and interviews are also pursued during the wildfire season and typically address current fire danger, or contain positive information concerning Complex staff assisting on interagency fire assignments out of the area. These types of articles promote pride in the Complex fire management program within the local community, especially since the backbone of our firefighting staff were born and raised in the area.

Fire prevention articles and interpretive tours to school groups are also utilized, and interpretive bulletin boards concerning fire management operations are periodically installed at Complex information kiosks.

#### XIV. ARCHAEOLOGICAL/CULTURAL/HISTORICAL RESOURCES

Fire management activities within the Complex will be implemented in accordance with the regulations and directions governing the protection of cultural resources as outlined in Departmental Manual Part 519 (519M), Code of Federal Regulations (36 CFR 800), the Archeological Resources Protection Act of 1979, and the Archeology and Historic Preservation Act of 1974. National Historic Preservation Act of 1966 section 106 clearance will be followed for any fire management activity that may affect historic structures or archeological resources.

No significant historic or prehistoric resources have been identified on the Arrowwood NWR. Several sites within the boundaries are listed but the importance of them is unknown. These sites consist of pits, rings and mounds, presumably from the nomadic indians that occupied the plains in prehistoric times.

Currently wildfires are suppressed. However, historical evidence demonstrates that natural and artificial fires were regular events in the mixed grass prairie. In recent years, fire suppression has resulted in a steady buildup of grassland and riparian fuel loads, colonization of disturbed soils by invading plant species, and natural vegetative growth, increasing the chances of an uncontrolled wildfire that could potentially endanger the Refuge's cultural resources as well as surrounding private property. Although over 20 years of fire ecology research allows ecologists to predict impacts on biotic communities, the possible impacts of prescribed burning (and wildfires) on archeological resources are not well known.

Heat from grassland fires rarely penetrates more than a centimeter into the soil. Impacts of grassland fires on artifacts and other materials in subsurface settings will be negligible even if they are buried only a centimeter or less below the ground surface (Wright and Bailey, Vogl). Knudsen (Fire in Ecosystem Mgmt. 1996) states that architectural surfaces can be damaged at temperatures above 300 degrees centigrade, lithics (stone tools) above 500 degrees C, Ceramics (pottery) above 600 degrees C, and bone above 400 degrees C.

Research conducted by Sayler, Seabloom, and Ahler at Knife River Indian Villages National Historic Site in North Dakota indicated that fire related impacts to buried artifacts are negligible, but effects on surface-exposed artifacts may be significant depending on fire conditions, artifact type, and size (Seabloom et al 1991). Potential damage may include scorching, charring, and spalling. Secondary impacts are created by erosion and vandalism. The severity of fire related effects can be controlled and diminished to some degree by controlling the fireline intensity at the time of the burn. The conclusions drawn by the Knife River studies have received criticism by fire management professionals due to the incredibly high temperatures and long fire durations indicated during the study burn. These temperatures and durations far exceed anything normally seen in this fuel type (fuel model 1), and are greatly outside the parameters displayed by the BEHAVE fire behavior prediction runs for similar conditions.

Given the historic frequency of fire in this ecosystem, which has been established at anywhere from 3 to 10 years (Davis & Mulch 1996, Pyne 1982 & 1996), any surface and subsurface artifacts would likely have undergone a minimum of at least 6-10 fire disturbances since Europeans arrived in the second half of the 19th century. Based upon this fire frequency research, prior to European settlement, this area received an average of 10 to 30 fire disturbances per century. It is logical to imply that most potential fire damage to ancient Native American artifacts existing on Complex lands may have occurred well before the area came under Service management.

Impacts to archeological resources by fire activities vary. The four basic sources of damage are (1) fire intensity, (2) duration of heat, (3) heat penetration into soil, and (4) suppression actions, (5) erosion and greater visibility that may encourage collection. Of the five, the most significant threat is from equipment during line construction for prescribed fires or wildfire holding actions (Anderson 1983).

Fireline construction that causes soil disturbance including heavy equipment use and handline construction can damage artifactual remains by displacement, subsurface exposure or by covering sites with above normal fuel loadings (jack pots) which can obscure artifacts and also build up fuels that can create abnormally high heat levels on subsequent fires. Concentration of people on sites during suppression activities can cause increase artifact poaching or soil compaction (fire camps etc.). Mop-up damage can occur from digging up burning roots or hydraulic mining with water, rehabilitation techniques such as waterbarring, berm leveling, and reseedling can also cause damage. Even retardant use can cause damage to artifacts by exposure, corrosion, or direct force (standing structures) (Knudsen, 1996).

Fortunately, typical suppression tactics in this fuel type consist of direct attack with engines or indirect attack by backing off the main fire and utilizing a burn out operation off a natural or human made barrier (lake, river, road). Although the practice of initial attack fireline construction by discing is commonplace on state and private lands around the refuge, it is an extremely uncommon practice on Complex lands, and would only be used as a last ditch method to protect human life or property.

A moderate percentage of Complex lands were at one time in cultivation. On these areas, damage to above ground artifacts can be assumed to be of minimal importance from current fire operations based upon damage that likely has already occurred from the previous land use.

**The following actions will be taken to protect  
archeological and cultural resources: on the Complex:**

- ! Files and records of cultural resources should be consulted by the staff when planning prescribed burns, developing pre-attack plans, and performing other preparedness actions. The potential for adverse impacts to cultural resources will be evaluated prior to prescribed burning and in the selection of fire

suppression strategies during wildfires.

- ! The Regional Archeologist will be contacted during the development phase of the burn plan writing process when cultural resources are suspected or known to exist in the project area.
- ! The North Dakota State Historic Preservation Officer (SHPO) will be contacted by the Regional Archeologist when it is known a planned management action may impact archeological or cultural resources. The SHPO has 30-days to respond. The Refuge will follow any programmatic archeological/cultural resources management plan that may be implemented in the future.
- ! Low impact wildfire suppression tactics (cold-trailing, use of foam/wet-water/water, use of natural and manmade barriers, change in vegetation, mowing, etc.) will be used to the fullest extent possible. Line construction for prescribed fire activities will follow the same principle. Maps indicating the known location of significant cultural resources will be consulted prior to laying out burn units, and whenever possible, before constructing fireline to halt the spread of a wildfire.
- ! Prescriptions for management ignited prescribed fires will take into account the presence of known cultural sites. Cooler fires with short residence time will be used in areas containing known cultural sites, whenever possible.
- ! Known surface sites will be marked, protected, and excluded from the burn, if possible. Foam will not be used in areas known to harbor surface artifacts.
- ! The use of mechanize equipment within the refuge must be approved by the Refuge Manager on a fire by fire basis, and the use of these resources will be considered in the approval process for any planned management actions. When the use of heavy equipment is authorized, its use will be monitored.
- ! The location of sites discovered as the result of fire management activities will be reported by the ROS to the Regional Archeologist.
- ! Rehabilitation plans will address cultural resources and will be reviewed by the Regional Archeologist.

#### **XV. FIRE CRITIQUES AND PLAN REVIEW**

This Fire Management Plan will be reviewed annually (no later than November 30) to ensure the fire program advances and evolves with the Service and the mission of the Complex.

Wildfires will be critiqued by the IC. The RFMC will conduct formal fire critiques in the event of:  
- significant injury/accident/fatality

- significant property or resource damage
- significant safety concerns are raised
- an extended attack is necessary

Prescribed fires will be critiqued by the burn boss and documented in the burn plan. The RFMC will conduct a formal critique in the event of:

- significant injury/accident/fatality
- an escape prescribed fire occurs
- significant safety concerns are voiced
- smoke management problems occur

Approximately once every four years a formal fire management review will be conducted on the Complex. This review will typically be conducted by the Zone FMO, RFMC and Regional Prescribed Fire Specialist and will follow the current format as outlined by the Regional Fire Office.

#### **XVI. CONSULTATION AND COORDINATION**

All fire management program activities will be implemented in cooperation and coordination with the State of North Dakota, North Dakota Department of Environmental Health, and rural fire protection districts. Other agencies and organizations will be consulted with as needed.

General program consultation and coordination will be sought from the North Dakota Zone FMO, the Regional Fire Management Coordinator, Regional Prescribed Fire Specialist, Service staff located at the National Interagency Fire Center (NIFC) in Boise, Idaho, cooperating agencies within the North Dakota Fire Council, North Dakota Interagency Dispatch staff, and fire managers and fire ecologists/biologists throughout the northern great plains.